COLORADO SCHOOL OF MINES MAGAZINE

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VOLUME X

January 1, 1920, to December 31, 1920

THE COLORADO SCHOOL OF MINES ALUMNI ASSOCIATION, PUBLISHERS, GOLDEN, COLO.

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The Present Status of the Oil Shale Industry*

By Victor C. Alderson†

THE COMMERCIAL ASPECT.

The Price of Well Petroleum.—The oil shale industry, to be a commercial success, must compete in the open market with crude oil from wells. In recent years, the supply from wells had not been sufficient to meet the demand for oil and yet more oil. If any one has a lingering doubt about this fact, the very recent advances in the price paid by the pipe lines for crude oil in the wells should be an unanswerable argument. Recent trade quotations give:

Pennsylvania crude, $5.00 a barrel (in 1913, $2.05 a barrel).

Wyoming fields, $2.00 to $2.60 a barrel (Grass Creek, $2.60; Elk Basin, $2.40; Lance Creek, $2.55; light oils in other fields $2.25),

Eastern fields, $2.75 to $3.35 a barrel.

Mid-Continental field, $3.00 a barrel (in 1913 quoted at 83 cents; $3.00 is the highest price ever paid for crude oil west of Chicago; this is the third increase in six weeks).

North Louisiana, $2.40 to $2.65 a barrel.

The Cost of Crude Shale Oil.—Conservative estimates give the cost of producing crude shale oil as follows: Assume a well-equipped, efficient plant of 400 tons daily capacity, treating 400 tons of shale yielding one barrel of oil to the ton of shale:

Mining, ton or barrel	$1.25
Breaking	.10
Retorting	.35
Loading and shipping	.05
Amortization, interest, overhead expense, etc.	.10
Cost of barrel of crude shale oil	$1.85

Shale Versus Well Oil.—Crude shale oil, when produced, will naturally first come into competition with the Wyoming and Mid-Continental oils. Since the estimate of $1.85 is conservatively high, the lowest competitive price ($2.00 in the Wyoming field) and the highest price, $3.00 (in the Mid-Continental field) are both well above the danger line. If, then, oil shale retorting plants were now in effective operation on a commercial scale there is little doubt that their product would find a ready market at a remunerative price. There is, too, every reason to believe that the price of oil has only begun its upward course and much higher prices will soon be reached.

Nor will the price of crude oil alone remain high. On account of the present large foreign demand, in addition to the strong domestic demand, the prices of lubricating oils and kerosene will very likely first be affected by the advance in crude oil. The shortage in the supply of gasoline is an additional factor which will help to advance its price also. Other refinery products are also due for an advance. All of which will aid materially in placing the oil shale industry on a profitable basis.

The recent coal strike has brought home to the large consumers of coal the danger of depending solely upon coal for fuel. Already many of the large New York and New England manufacturing plants are changing to oil. Many ocean steamships, as well as those on the Great Lakes, are also changing. In Chicago all the public school buildings, in units of ten at a time, are being changed to use oil for fuel.

On railroads fuel oil is fast coming into favor on account of the low labor cost, the convenience, and the high efficiency.

The following railroads now use fuel oil over all or a considerable part of their lines: Atchison, Topeka & Santa Fe, Southern Pacific, Kansas City Southern, Western Pacific, Northwestern and Pacific, Florida East Coast, Chicago, Milwaukee & St. Paul, Great Northern, Oregon Short Line, Texas & Pacific, Chicago, Burlington & Quincy, Chicago & Northwestern, El Paso Southwestern, Delaware & Hudson (Adirondack Division), New York Central (Adirondack Division), Oregon-Washington Navigation Co., Texas Railways, Missouri, Kansas & Texas.

THE TECHNICAL ASPECT

The Retort.—The price of crude well petroleum and the general demand for oil are factors over which the individual has but little control. The construction of a retort to produce oil from shale is, however, a problem for the individual. Many unthinking persons reasoned that, since shale has been retorted in Scotland for the past sixty years, a retort of the Scotch type could be erected here, oil produced, and success would immediately follow. Unfortunately such reasoning does not hold good. The Scotch shale is

* Published jointly with The Railroad Red Book.

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low in oil value, but high in nitrogen; the American shale is high in oil but low in nitrogen. The most valuable Scotch product is ammonium sulphate; ours will be oil. The Scotch retort is built as a double chamber; in one, oil and gas are produced at about 800 degrees;* in the others, the nitrogen at a temperature of 1,700-1,800 degrees.* The successful American retort will necessarily be one-chambered and quite distinct in plan and operation from the Scotch; hence the necessity for preliminary experimental work to evolve a distinct type or types for American shale. Some of the necessary characteristics of a successful retort are easy to state, but difficult to realize in practice, viz.:

1. The feed should be continuous.
2. The oil should be produced at the lowest possible temperature and removed at once.
3. The oil, gas, and shale residue should be continuously removed.
4. Heat should be applied uniformly.
5. The shale should not cake or gum.
6. Each retort should handle a large amount of shale a day.
7. Accessory machinery should be automatic.
8. Hand labor should be reduced to a minimum.
9. A retort should be simple in construction and as near "fool proof" as possible.

Plant of the Catlin Shale Products Co., at Elko, Nevada. Constructed during 1919. Photograph taken in December. (Cut by courtesy of The Red Book)

Most of these specifications are based upon the principle that the production of shale oil must be on a large tonnage basis, like the porphyry coppers in metal mining.

Practical Development.—For the past three years R. M. Catlin of Franklin, N. J., has been experimenting at Elko, Nevada, on a commercial scale. The shale runs about fifty gallons to the ton. The

* Degrees Fahrenheit.

retort has a daily capacity of 100 tons. The plant consists of retorts, condensers, oil stills, agitator, wax plant, gas producer, storage, tanks and packing rooms. The products for the market are distillate, kerosene, lubricating oil, paraffin wax, and gasoline. About 15,000 gallons of shale oil have thus far been produced, but Mr. Catlin does not yet regard his plant, though of commercial size, as beyond the experimental stage.

The Southern Pacific Company has financed the erection of a full sized Pumpherston (Scotch) unit at Elko, Nev., which is in charge of Dr. David T. Day. The retort is completed and in operation, but reports of the results are not yet available.

The Wyoming Shale Oil & Refining Company owns 640 acres of shale land in the Bitter Creek district, in Sweet Water County, Wyoming. The shale is unusually rich and averages from fifty-eight to sixty-four gallons to the ton. The company plans to erect an eduction plant this spring.

The American Shale & Petroleum Company owns 1,240 acres of shale land in Sweet Water County, Wyoming. It intends to begin the erection of a Jenson retort April 1, 1920.

The Mt. Blaine Oil Shale Company owns 2,100 acres on Roan Creek, thirteen miles from De Beque, Colorado. The directors of the company intend to erect a Galloupe retort this spring.

At Grand Valley, Colorado, the Consumers Oil & Shale Company of Chicago and the Grand Valley Oil & Shale Company, have spent $25,000 in building roads to their property, preparing building sites, erecting buildings, all preparatory to erecting a 150-ton retort of the Stalmann type in the spring. The total cost is expected to be $100,000. The installation is being done by the Petroleum Engineering Company of Kansas City, Mo., under the personal supervision of Joseph Bellis, Otto Stalmann and J. B. Jones.

The Mt. Logan Oil Shale Mining & Refining Company at De Beque, Colorado, has in process of erection a Simplex retort, manufactured by the Stearns-Roger Manufacturing Company, Pueblo, Colo. Operations on a commercial scale are expected early this spring.

Pumpherston (Scotch) Process Plant, Elko, Nevada. Constructed 1919 by the Southern Pacific Co., under Direction of the U. S. Bureau of Mines. Photograph taken in December. (Cut by courtesy of The Red Book)

The Continental Oil Shale Mining & Refining Company has completed a 50-ton plant, known as the Colorado Continuous Shale Process, designed by Hartley & Dormann, engineers, Denver, in Rio Blanco County, Colorado, and has made a successful run. Bad weather and deep snow have, however, prevented further work until spring, when the company expects to renew operations and to run continuously on a commercial scale.

The Ute Oil Company has nearly completed a plant of the Wallace type with a daily capacity of 400 tons, at Watson, Utah. There are eighteen retorts, of one-ton capacity each. The time of treatment is estimated at fifty-eight minutes; the time for discharge and re-charge ten minutes. The structure is of steel and concrete, with mechanical devices in all the details of handling. The cost is estimated at $350,000. Installation is nearly complete and operations will begin early in the spring.

The Western Shale Oil Company has a sixteen-ton retort of the Galloupe type nearly completed at Dragon, Utah.

The Gas Machinery Company, of Cleveland, Ohio, are now preparing plans for the first 200-ton unit of a 2,000-ton plant of the Wallace type, to be erected by the Shale Oil & Refining Corporation in the De Beque, Colorado, district. Early summer will probably see this unit in operation.

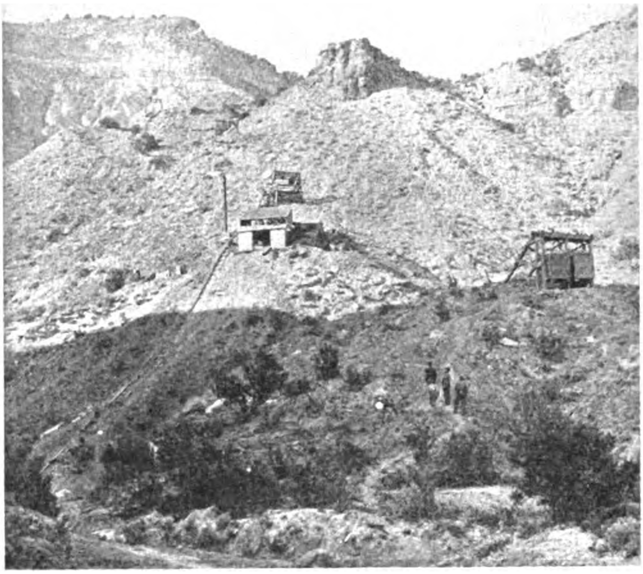
At the Colorado School of Mines two retorts, each of commercial size, are under construction, viz:

A Stalmann retort by the General Petroleum Company, of Kansas City, and a Wallace retort by Geo. W. Wallace, of East St. Louis, Illinois.

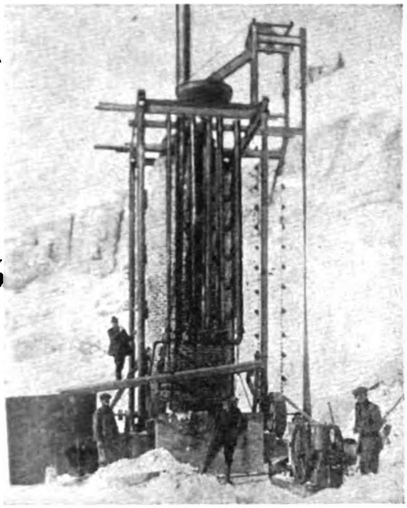
On the completion of these retorts, the Colorado School of Mines will be prepared to make complete retorting tests on oil shale in commercial quantities.

Water Supply in Colorado.—A plentiful supply of water is one of the essential requirements for a successful eduction plant. The absence of water makes the richest oil shale deposit virtually worthless. R. E. Meserve, a western slope engineer, is authority for the following estimate of the water supply in western Colorado:

"A reservoir covering four acres fifteen feet deep holds sixty acre feet. One cubic foot of water per second flowing thirty days will fill it, as will also three and one-half statute inches flowing for a year. There are a thousand places on Roan Creek and its branches, suitable for oil shale plants, where reservoirs of this capacity can be built and filled from the spring run-off, summer floods and winter flow, without lessening irrigation. State engineers' reports for 1905 and 1906 show an appropriation for irrigation of 150 second feet for a total cultivated area of 3,000 acres. At five acre-feet per acre, this would take 1,000 acre-feet. Precipitation may be put at fourteen inches, on the 270 thousand acres of this field, and using one-third for available run-off, we have 85,000 acre feet left above all irrigation. This is enough for a million tons of oil shale per day, 300 days a year."



Plant of the Mount Logan Oil Shale Mining & Refining Co., now in Course of Construction, near De Beque, Colo.
(Cut by courtesy of The Red Book)



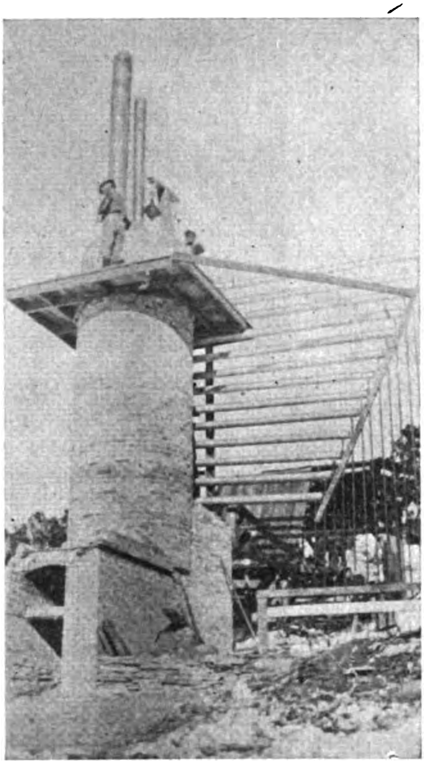
Plant of the Continental Oil Shale Mining & Refining Co., Rio Blanco, Rio Blanco County, Colo. A 50-ton Unit. Constructed during 1919. Photograph taken in December.
(Cut by courtesy of The Red Book)

THE FINANCIAL ASPECT

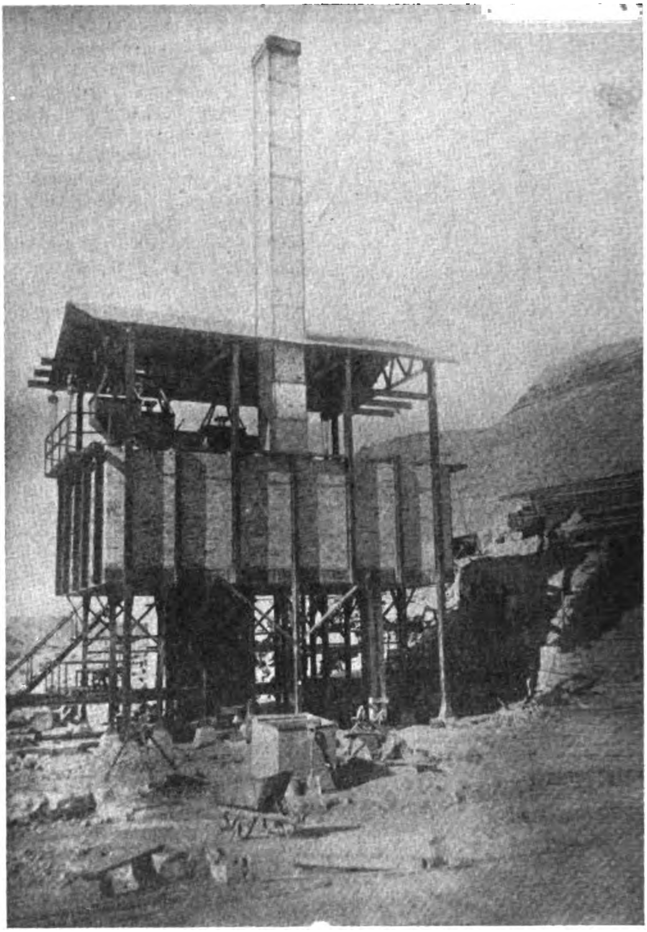
Capital.—It should be borne in mind that the oil shale industry is not a "poor man's game" in the sense that a small amount of capital invested will bring fabulous returns. On the contrary, it is distinctly a "rich man's game", in the sense that a large amount of capital must be invested before there is any return whatever. The smallest unit— and that only as a starter—should be of 100 tons daily capacity to cost approximately $100,000. This unit should be added to, till at least 500 tons a day are reached and 1,000 would be much preferable. Another phase that should be emphasized is that the oil shale industry is a low-grade industry, of large tonnage, of continuous operation, with automatic machinery, and large output. Workmen need only to be "broad in the back". The brains must be supplied in the office. The greatest need of the industry at the present moment is capital to open the deposits, erect retorts, establish refineries, organize distributing agencies, and in brief, to establish the industry on a commercial scale and a paying basis.

The Future.—Rapid as has been the increase in the demand for crude oil and its products, yet the future holds out even greater expectations. There are now approximately 7,500,000 internal combustion engines in the United States. In ten years this number will very likely be doubled to 15,000,000. In spite of the phenomenal growth of the automobile industry, there is no indication of a slackening. Good authorities assert that the next five years will show even a greater increase, or fully 10,000,000 motor cars in operation. The Ford plant alone will manufacture 500,000 tractors in 1920. The United States Shipping Board has ordered that all vessels greater than 5,000-ton dead weight, shall be oil burners and has contracted for 31,000,000 barrels of fuel oil for 1920. France will require 8,400,000 barrels and Italy 336,000,000 barrels of oil in 1920. The potential demand for oil in the United States by 1927 is estimated at 800,000,000 barrels, and yet it is predicted that all well reserves will be exhausted by 1928. But in Colorado alone there is enough easily accessible oil shale to keep 100 plants, each treating 2,000 tons a day, in continuous operation for 800 years.

George Otis Smith, Director of the U. S. G. S., in a recent paper before the American Institute of Mining and Metallurgical Engineers, expressed himself as follows:



Plant of the Western Shale Oil Co., near Dragon, Utah. Galloupe Process, 16-ton Unit. Constructed during 1919. Photograph taken in December.
(Cut by courtesy of The Red Book)



Plant of the Ute Oil Co., now nearing completion at Watson, Utah. Wallace Process, 400-ton Daily Capacity. Photograph taken November, 1919.
(Cut by courtesy of The Red Book)

"The position of the United States, in regard to oil, can best be characterized as precarious. Using more than one-third of a billion barrels a year, we are drawing not only from the underground pools but also from storage, and both of these supplies are limited. In 1918 the contribution direct from our wells was 356,000,000 barrels, or more than one-twentieth of the amount estimated by the survey geologists as the contents of our underground reserve; we also drew from storage 24,000,000 barrels, or nearly one-fifth of what remains above ground. In a single decade, then, the consumption of fuel oil by railroads has more than doubled; the consumption of gasoline has increased seven-fold. With the rapidly mounting cost of coal, the competitive field of fuel oil for steam use is expanding. We may lessen the increase in coal or oil consumption for generating power by harnessing the water powers of the country; but prime movers, whether driven by steam or water, require lubrication.

"A most serious aspect of our oil problem presents itself when we consider the entry of the United States as a real factor in the shipping of the world. Any nation that aspires to a large part in the world's commerce imposes upon itself an oil problem, for the future freedom of both the sea and the air will be defined in terms of oil supply."

Oil Shale Comes into its Own.—What have all these estimates to do with the oil shale industry? Simply this. Oil is the fuel of the future. Greater and greater demands are being made upon well oil. Great as are some oil pools, yet the average production falls short of the demand. The only recourse is to the vast stores of oil shale in which lie the potential elements of the future supply of oil. Oil shales are found virtually all round the world. The demand for oil is now strong enough and the price of crude high enough to warrant the commercial production of oil from shale. A number of plants are now nearing completion so that there is every likelihood that the industry will be on a commercial basis in the summer of 1920.

The Requirements of a Furnace or Apparatus for the Maximum Production of Oil from Oil Shale

By Albert H. Low.*

Definitions of Saturated and Unsaturated Hydrocarbons.

Before beginning this discussion it may perhaps be well to give definitions of one or two of the terms to be used. These definitions are not claimed to be complete, but they will suffice for all present purposes.

By "hydrocarbon" is meant a compound formed by a union of the element carbon with the element hydrogen. These compounds are very numerous and some of them are very complex, large numbers of carbon and hydrogen atoms being able to combine together to form all sorts of products. Some of the hydrocarbons are gases, some are liquids, and some are solids. The simplest hydrocarbon is the gas methane. It consists of one atom of carbon combined with four atoms of hydrogen. Here a single atom of carbon has gone its limit and united with all the hydrogen it can. This brings us to the consideration of another term, the term "saturated". In the case at hand the compound, or hydrocarbon, is called "saturated" because the carbon atom has taken on or combined with all the hydrogen possible. Now while a single atom of carbon can take on only four atoms of hydrogen, two atoms of carbon can unite with each other, forming a nucleus that can unite with six atoms of hydrogen. This is the limit of this nucleus as regards hydrogen, and the result is again a "saturated" compound. But it can also form a stable compound without going the limit, by simply uniting with only four atoms of hydrogen, and this compound still possesses the power of uniting with two or more atoms of hydrogen on occasion. Such a compound, having a reserve of combining power, is called "unsaturated".

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Both petroleum and shale oil consist mainly of liquid hydrocarbons. Hydrocarbons, such as ordinary paraffine, that, if removed and purified, would be solid, are dissolved in the oil, so that the whole is liquid. Most of the hydrocarbons in both petroleum and shale oil are of the saturated variety, but some unsaturated hydrocarbons are always present and they are undesirable constituents to be removed by refining. They have not the stability of the saturated compounds and easily undergo decomposition with the production of color and odor. The larger the percentage of unsaturated hydrocarbons present, the less the final yield of refined oil.

Nature of Oil Shale.

Bearing the above facts in mind, I will proceed to consider the nature of oil shale and the oil produced from it.

Oil shale contains no oil as such, that is, no oil can be obtained from it by solvents or by pressure. It is a hard clay rock, having disseminated throughout its mass a hydrocarbon material called "Kerogen". When the shale is subjected to sufficient heat the kerogen is decomposed, or undergoes what is called "destructive distillation". If the vapors produced are collected and cooled there is obtained mainly an oily liquid, together with a small amount of gas that fails to condense to a liquid and is therefore called "permanent gas".

According as the same shale is heated or distilled under varying conditions, the resulting products vary greatly, both in their nature and amounts. The reason for this is that the substances evolved from decomposing shale are themselves liable to still further decomposition into other substances, if, after leaving the shale, they happen to encounter, during their escape, a still higher temperature than that which produced them.

Imagine an upright iron pipe, say ten feet high and one foot in diameter, closed at the bottom and filled with lumps of broken shale. Suppose, now, the lower five feet of this pipe to be immersed in a furnace that will raise the entire immersed portion to a dull red heat. It is obvious that the shale nearest the outside of the pipe will reach a decomposing temperature and begin to distill before sufficient heat to effect decomposition has reached the shale in the central portion of the pipe. Thus the outside layer of shale may become entirely exhausted of volatile products while shale in the interior is still undergoing decomposition. The spent shale nearest the outside will continue to get hotter until its temperature is far above what was originally required to decompose it, while the interior shale is still giving off an abundance of volatile products. These interior products naturally take the easiest line of escape to the top of the pipe. The hot, exhausted outer layer of shale has by this time shrunken away from the walls of the pipe somewhat, so as to leave a more or less open channel toward the top of the pipe as far as sufficient heat has reached. The gases coming from the interior will therefore seek this channel of escape in preference to the much more obstructed course up through the center of the pipe. During their exit up along the sides they thus pass through highly heated material and are exposed to temperatures much higher than the temperature of their production. This causes them to decompose into secondary products that are able to exist at these higher temperatures. Now it so happens that the original products of the distilling shale that has reached a proper decomposing temperature, give, after condensation by cooling, less permanent gas and a larger quantity of oil, which is of better quality than if these original products, during their escape, are exposed to higher temperatures and thus suffer secondary decomposition. This secondary decomposition results in the formation of a much larger percentage of the undesirable unsaturated hydrocarbons and more permanent gas, thus after cooling and condensation, giving less total oil, which is of a poorer quality, so that when refined and the unsaturated hydrocarbons are removed, there is obtained less refined oil per gallon of the original crude oil.

Fundamental Principles of Retorting.

One of the most important considerations, then, in the distillation of shale, and it cannot be too strongly emphasized, is to remove the original escaping vapors, as fast as they are formed, in such a way as to prevent them from becoming further heated much above the temperature of their formation. Requirement No. 1, then, is to avoid overheating the original escaping vapors during their exit from the retort or furnace.

It will be observed from the above that the production of the maximum quantity of oil results also in producing oil of the best quality, that is, oil containing the minimum amount of unsaturated hydrocarbons.

In addition to the above it is found that when shale oil itself is again vaporized or distilled by the direct application of dry heat, it is liable to still further decomposition with the formation of more unsaturated hydrocarbons. Therefore, if the original vapors, in escaping from the still, encounter a cool place, so as to become more or less condensed into liquids, that are again vaporized as the place gets hotter, the result is again the formation of more unsaturated compounds. The situation is worse if the condensed oil drips back into a very hot place in the retort. Requirement No. 2, therefore, is to avoid any condensation of the vapors before leaving the retort. It will be remembered that the iron pipe previously referred to was filled with shale to the top, while only the lower half of the pipe was heated. Condensation, therefore, would be sure to take place in the cool, upper portion, and some of the condensed oil would be sure to drip back into the hot places below. Also, if the heating were made continuous, by the removal of spent shale from the bottom and the addition of raw shale at the top, the shale holding condensed oil would gradually settle and get hotter until the condensed oil was again vaporized. The entire arrangement of retort and heat is therefore poor.

A third point to be considered relates to the application of heat to the shale. Shale is a very poor conductor of heat, so that if a body of shale is heated from the outside it takes a long time for sufficient heat to effect decomposition to reach the center of the mass, even though the outside has become spent and much overheated. Obviously, then, there is an economical limit to the depth or thickness of a body of shale to be heated in this way, as less time, and therefore less heat, will be required if the shale is treated in consecutive thin sections instead of one thick mass. Experiments have shown that when the heat used is just sufficient to completely carbonize or exhaust a four-inch thickness of shale, it will take twice as much heat to carbonize a thickness of six inches. In other words, by increasing the thickness of the shale 50 per cent, the heat required has been increased 100 per cent. As a practical illustration of how this works out on a large scale, I will quote from the only statements I have available.

In the so-called Scotch process of distilling oil shale the ordinary retort used has a capacity of one hundred and fifty cubic feet and the through-put is four and one-half tons each twenty-four hours. I am unable to state the thickness of the shale in the retort, but it presumably is more than a few inches. In one of the new American processes the retort has a capacity of only fifty cubic feet and takes two tons of shale at a charge, the thickness of the shale as arranged in the retort being only four inches, or a little less. Such a charge can be completely carbonized in about an hour, resulting in a through-put of from forty to forty-eight tons of shale each twenty-four hours.

In the American process referred to, a thickness of about four inches of shale, broken to a maximum size of about one and one-half inches, has been adopted as the most economical arrangement for that process, to obtain the best results. Requirement No. 3, then, is to study the proper thickness of the body of shale to be distilled to attain the most economical working conditions, that is, the least expenditure of time and heat.

In the above statements relative to the application of heat to the shale, the shale is supposed to be at rest, that is, not agitated or revolved while undergoing distillation. It is quite possible that, bearing the above principles in mind, different types of rotating or agitating arrangements could be designed so as to overcome the heating difficulties in some other way with equal or even greater efficiency.

I will lay no special emphasis on the size to which the shale should be crushed or broken, as this depends in a large measure on the process used, or the particular retort or other heating apparatus employed. It is evident that if a large lump of shale is strongly heated on all sides at once, its exterior may become exhausted and overheated while the interior is still undergoing decomposition, evolving products that must thus suffer overheating and secondary decomposition in their exit from the lump.

"Cracking."

I have several times spoken of this secondary decomposition as resulting in the formation of undesirable unsaturated hydrocarbons, with the consequent reduction in the quantity and quality of the oil obtained. The technical term applied to this decomposition is "cracking," as the original oil breaks up or "cracks" into other substances. All of these substances are not of the unsaturated kind. Some are both saturated and desirable, and cracking is one of the methods resorted to in the process of refining to obtain an increased production of such light oils as gasoline, but this intentional cracking is carried on under carefully controlled conditions, which are quite different from the undesired cracking that may occur during the distillation of the shale. And this brings us to the question: "How may this original cracking be prevented or minimized?" I have already stated that it may be largely avoided by removing the gaseous products just as they are evolved from the shale, without allowing them to become either overheated or condensed before leaving the retort. How this can be done is a matter of invention, but it apparently has been accomplished by at least one or more American processes. A second method is to control the temperature in the retort by the introduction of superheated steam. This is done in the Scotch process, with the two-fold object of equalizing the temperature and increasing the production of ammonia. I will refer to the question of ammonia water. While the use of steam does much in the way of preventing cracking it has two great disadvantages, besides the consumption of much more heat in the distillation. It is customary to use as much as half a ton of steam for each ton of shale retorted. All this steam has to be condensed, and, as it may equal in amount several times the total volatile products produced from the shale, the condensing apparatus must be correspondingly increased, with a like increase in cost. This is a serious objection to the use of steam. A second great disadvantage is that the steam and oily vapors are condensed together, forming an emulsion of oil and water that may require weeks to separate. This makes the oil hard to handle, besides necessitating increased storage facilities.

On account of the disadvantages noted, it therefore appears inadvisable to use steam if it is possible to avoid it. This point may be regarded as Requirement No. 4.

Another method of avoiding overheating and cracking during the distillation, and which, according to the inventor, gives satisfactory results, is to pass the crushed shale in stages through ovens heated to different temperatures, beginning with a low temperature, where the heat is just sufficient to start the decomposition of the shale and produce the more volatile products, and continuing through a second and third oven, with the latter sufficiently hot to completely finish the distillation. Heat is saved and the different temperatures attained under this plan by simply having one source of heat for all the ovens and passing the heat leaving the hottest oven to that of the next lower temperature, and so to the next. By drawing off the vapors separately from each oven and condensing them separately, a partial refining may be accomplished. Thus it is seen, as stated before, that methods for preventing or minimizing cracking are purely matters of invention.

Conditions Effecting the Recovery of Ammonia.

I will now pass to the question of the recovery of ammonia. Ammonia is a compound of nitrogen and hydrogen in certain definite proportions. If a complex organic compound or mixture happens to contain both nitrogen and hydrogen, even if no ammonia or ammonia compound is originally present, and this compound or mixture is heated until it decomposes, ammonia is liable to be formed from the evolved gases. This is precisely what occurs in the case of oil shale. Besides hydrocarbons, which of course contain hydrogen, the kerogen in the shale also contains some nitrogen compounds. When heated, the hydrocarbons in the shale will begin to decompose at a temperature of less than 700° F., and the nitrogen compounds will decompose at about 735° F. Ammonia will form in the mixed vapors and its quantity will depend upon the amount of nitrogen in the shale. If this ammonia is removed or drawn off from the retort without suffering overheating it will not be decomposed, but will remain as ammonia or an ammonia compound, to be subsequently easily recovered from the condensed products. It is a valuable by-product. If, however, the ammonia once formed again encounters a high temperature before leaving the retort, it is liable to be again more or less decomposed into its constituents—nitrogen and hydrogen. Ammonia will begin to decompose at a temperature a little above 900° F., and will be completely decomposed at a temperature somewhat about 1,400° F. In some processes, where provision is not otherwise made for preventing overheating, steam is used for equalizing the temperature, thus, at the same time, saving the ammonia from decomposition and minimizing the cracking of the oil vapors. It has been shown that this is not a desirable procedure if it can be avoided. Under the above conditions steam does not apparently assist at all in the formation of ammonia by any chemical interaction, but simply by equalizing the temperature, prevents its decomposition when once formed. Shale is said to contain certain nitrogen compounds that still hold nitrogen after all the oil has been expelled. This residue of nitrogen will now have present no hydrogen to combine with to form ammonia, although there will be some carbon in the form of coke. If this carbonized shale, while still very hot, be now treated with steam, which contains hydrogen and oxygen, both the steam and the nitrogen compound may decompose; the oxygen of the steam uniting with the carbon present to form carbon dioxide, and the hydrogen of the steam uniting with the nitrogen present to form ammonia. Under these conditions, therefore, steam is useful in obtaining an increased production of ammonia, but, of course, the disadvantages following the use of steam still remain, and the additional ammonia recovered may not be worth the increased trouble and expense.

Permanent Gas.

The valuable products sought in the distillation of oil shale are oil and ammonia. A certain amount of permanent gas is unavoidably produced, but as this gas is largely formed at the expense of decomposing oil, which is worth more than the gas, it necessarily follows that the production of the maximum amount of oil means the formation of the least gas. Whatever gas may be produced should, of course, be utilized in heating the retort, and it may, with the maximum production of oil, be sufficient to furnish about half the heat required. The additional heat necessary may be supplied by producer gas or otherwise, according to the conditions.

I have made no mention of the shape, size, or material of construction of a retort or heating apparatus, as these are variables depending upon the process, proposed output, location, and perhaps other considerations. I have also not taken up any questions relating to recovery of the products, and their refining, as being foreign to the subject at hand.

Resumé.

In view of the foregoing, the requirements of a furnace or apparatus for the maximum production of oil from oil shale, may be summarized as follows:

Requirement No. 1. Avoid overheating the original vapors produced, during their escape from the retort or furnace, and thus, as much as possible, prevent cracking and the consequent loss, both in the quantity and quality of the oil recovered.

Requirement No. 2. Avoid any condensation of the vapors before leaving the retort, thus forming liquid oil which will require to be again vaporized before expulsion. This second evaporation or distillation results in cracking and loss.

Requirement No. 3. Study the proper thickness of the body of shale to be distilled, so as to attain the most economical working conditions, that is, the least expenditure of time and heat.

Requirement No. 4. Avoid the use of steam unless considerations of the process used absolutely demand it, as steam occasions much extra trouble and expense.

In the above discussion I have made no attempt to go into the subject exhaustively; but have aimed rather to present the more salient requirements in as simple a form as possible, that those interested, but perhaps unfamiliar with the subject, might have a better understanding of the situation.

Diamond Drilling, the Ideal Method of Sampling Oil Shale Deposits

By C. Erb Wuensch, '14.

Impossibility of Sampling Shale Deposits from Outcrops.

We hear conflicting statements made as to the "oil content"* and thickness of the oil-shale strata of Colorado and Utah. The truth is, no one as yet knows! Engineers in government and private employ who have taken numerous samples are in accord, in that, it is absolutely safe to assume that there are thirty feet of oil shale strata, in beds more than three feet thick, that will yield one barrel (42 gallons) of oil to the ton. These figures are given to be well within the limits of conservatism. Others who are not so conservative have gone so far as to say that there are at least two hundred feet that can be mined in one body and which will yield an average of better than one barrel per ton.

The reason for these discrepancies is easily explained when one considers the magnitude and inaccessibility of the main oil shale strata in the middle member of the Green River formation. Where the whole formation is exposed in escarpments it is invariably two to five hundred feet high, vertically above the accessible slopes. Hence it is a physical impossibility to sample more than a few feet at the base. If the formation happens to be exposed along an accessible slope, the shale is most frequently of the "paper" variety which is not representative of the solid unaltered material that will be found at some distance from the outcrop. In any event, it is a fact that no one vertical section of the whole formation can be accurately obtained from the surface and outcrops of the cliffs.

Applicability of the Diamond Drill.

From this, it must not be inferred that it is beyond the range of human possibility to accurately sample the shale deposits. The shale beds lie practically flat and the tops of the shale cliffs are composed of gently rolling hills and relatively level expanses, called mesas. Practically every one of these mesas has at least one accessible trail to the summit over which it would be possible to use pack animals. Because of these topographical features, the logical method of sampling the oil shale deposits is by the use of the diamond drill. The diamond drill can be set up on tops of the cliffs and vertical holes bored through the whole formation below.

Brief Description of Diamond Drilling for the Uninitiated.

The diamond drill is nothing more than a series of hollow rods that are screwed together in five or ten foot sections, and at the bottom of which is attached a bit, or cutting tool which is set with diamonds (borts). The rods are rotated by a suitable engine, which for work of this sort is usually driven by steam. As the rods are rotated the diamond bit cuts a circular groove in the rocks and leaves a solid section of rock, or "core," within the center of the rods. At intervals the rods are withdrawn and the core removed. A "core-barrel" is placed in the section of rods adjoining the bit. This

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* Technically speaking, "kerogen content," because oil shale contains no oil as such. It is only by the proper application of heat in the destructive distillation of oil shale that oil is formed by the condensation of the educted gases.

holds the core within the hollow of the rods while the latter are being withdrawn from the hole.

The diamond drills for this sort of work are made sectionalized, in order that the individual parts are light enough to be easily packed on animals for use in inaccessible places. In addition to the drill, a small sectionalized boiler is used to generate power for the drill and a pump. The latter is used to force water down the hollow rods. The water removes the cuttings which enables the bit to efficiently operate against the solid rock. The water also serves to keep the bit and diamonds cool.

Technical Data on Diamond Drilling Oil Shale Deposits.

Although there is no actual data on the results of diamond drilling oil shale deposits, there is considerable data available relative to diamond drilling coal deposits. Since the rocks encountered in coal and oil shale fields are practically identical, what applies to one holds equally true for the other, with perhaps one exception. In prospecting for coal it is not necessary to attempt to make a large recovery of core except of the coal itself. In drilling oil shales it will be necessary to make as much core of the whole formation as is possible.

In order to secure a large enough sample to make tests of the various strata, it will be advisable to use a drill which will make a two-inch core. By drilling at the proper speed it will be possible to recover approximately 95 per cent of the formation drilled. About 10 to 15 feet advance should be made per eight-hour shift using two men. The holes will range from 200 to 1,000 feet in depth, averaging about 500 feet. Because of the time that will be consumed between set-ups it will probably cost about $3.50 per foot drilled. It will require a 15 to 20-h. p. boiler to operate a two-inch core drill under the conditions prevalent in the shale fields.

Conclusion.

Diamond drilling is the ideal method of sampling oil shale deposits. It makes it possible to take a complete and accurate sample of the whole oil shale formation at any one point. Every bed and seam can be sampled, and their richness and thickness absolutely determined. The operator will be able to figure whether it will be most profitable to mine the individual seams of richer shale, at a higher cost of mining and a lesser recovery of the total amount of oil available, than to mine the whole formation, stripping the barren material and mining lower-grade shale, with a lower mining cost per ton handled and a higher recovery. He will know beyond a doubt the amount and grade of oil shale that he has available; data so vital to intelligently plan future operations. In addition to this, he will have obtained this information in the quickest possible time, with a maximum of accuracy and the minimum of expense. Now is the time to do this work.

The logical way of doing this work is for a number of companies to co-operate. By so doing, larger contracts could be entered into, and hence a cheaper rate per foot obtained. By thus "pooling" their interests a great deal of the general expense could be distributed over a number of operators. In addition to this, by exchanging the logs of the various holes drilled, fewer holes would have to be drilled by any one individual than if this work were attempted separately by each company.

ELECTRIC FLASHES.

Electrical and compressed air coal-cutting machines are shortly to be introduced into some of the coal mines of England, according to recent reports.

Electricity is being widely used in clearing the North Sea of mines. Many of the mines are sunk very deep, and have antennae which, when touched, cause the mine to explode. Special electric cables several hundred yards long are being used to explode these mines at a safe distance from the boat.

Electric plows are being tried out in Italy, and the trials have proved so satisfactory that it is probable electric plowing will become widely used. The cost has been shown to be less than one-third of the cost of the ordinary tractor work, and the fact that most of the fields are small and comparatively flat, and that the necessary power is available in practically every section of the country, makes Italy especially suitable for the experiment.

The Norwegian Fishery Administration is considering using electrically propelled boats in its fishing fleet. A considerable sum has been allotted for conducting research along these lines.

Electric heat is becoming more and more widely adopted in industrial processes—such as japan baking of automobile bodies, and brass melting furnaces, because of its numerous advantages over other kinds of heat. Some most evident advantages are the greater working temperatures obtainable, the absolute control of the heat, and the evenness of heat distribution.

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TECHNICAL REVIEW

GENERAL.

The Mineral Industries of France. By Maurice Altmayer. (E. & M. J., January 3, 1920.)

The author reviews in an authoritative manner the post war mineral situation and reconstruction period in France. He emphasizes the fact that despite the restitutions of the peace treaty with Germany, France faces a serious shortage of coal. A detailed and lengthy description is given of the post war position of the major metals. The exchange problem is discussed briefly. The article is simply an attempt to describe to the American reader a few of the means at the disposal of France to resume her position and rank in the world's activity towards progress and better times. W. S. L.

Wolfram Mining in China. By C. Y. Wang. (E. & M. J., January 3, 1920.)

A brief comment on the production of the metal that developed under the stimulus of the war demand. Government and military machinations render the future of the industry dependent on the sweeping reform of existing political conditions. W. S. L.

Mine Bookkeeping By C. B. Holmes. (E. & M. J., January 3, 1920.)

This article offers many suggestions as to the ways and means of effecting material economies in mining operations. the merits of a proper cost-finding system and of the detection of leaks by compiling daily reports of tonnages and labor costs, are praised highly by Mr. Holmes. W. S. L.

The China Clay Industry of the West of England. By Henry F. Collins. (Mining Magazine, November, 1919.)

China clay is, after coal, the most important of the limited list of raw materials that the United Kingdom can export.

The geographical distribution of the principal deposits of china clay in the West England is shown on a map which accompanies the article. Most of the output of the clay comes from the Hensbarrow district north of St. Austell. Nothing as yet has been found in the Wendron area.

The following topics are discussed in detail in this article:

1. Nature and composition of china clay.
2. Mode of occurrence.
3. Method of winning clay.
4. Separate and disposal of sands.

The article is accompanied by tables, photos and maps. It is to be continued in the next issue. F. A. L.

The Minerals of Anatolia. By Norman M. Penzer, B.A., F.G.S. (Mining Magazine, November, 1919.)

This article is continued from the October issue, page 221, and gives particulars of the mineral deposits of Asiatic Turkey, about which little is known in this country, though the Germans compiled records some years ago. The minerals and metals treated in this issue are: nickel, tin, arsenic, sulphur, borates, salt, lithographic stone and marble, kaolin and Fuller's earth, opals and bitumen. The article is to be continued in the next issue. F. A. L.

Mining Conditions in Russia. (E. & M. J., January 10, 1920.)

In this article a general review of mining conditions in Russia during 1919 are presented and some of the methods used for stimulation of mining are stated. High cost and scarcity of available labor have forced the mining industry in Russia to look to mechanical devices for the continuance of operations. W. S. L.

The Bunker Hill Enterprise—II. By T. A. Rickard. (Mining & Scientific Press, January 10, 1920.)

A continuance of the historical article dealing with early mining operations in Idaho. The first successful prospecting in the Coeur d'Alene district is dwelt upon. W. S. L.

MINING.

The Tin District of West Africa. By D. J. MacDonald, M. Inst. M. M. (Mining Magazine, November, 1919.)

In the mining magazine for May a brief summary on the Winnebah tin deposits, West Africa, made by the firm of Innes, MacDonald & Sealy. This article was written by Mr. MacDonald from the notes of Mr. A. C. E. Seale, who had been in charge of the prospecting work during the last six months.

The existence of a deposit of high-grade coarse alluvial cassiterite was found by a syndicate four years ago in the bed of a stream flowing into a salt-water lagoon on the seacoast about five miles west of the port of Winnebah.

The outbreak of the war put a stop to the operations, until they were renewed in 1918, under circumstances more favorable.

There are at least four or five companies now in operation upon these tin deposits or hold options on them.

F. A. L.

The Kelly Silver Mine, at Randsburg, Calif. By Jay A. Carpenter. (E. & M. J., December 27, 1919.)

A descriptive article dealing mainly with the romantic and accidental discovery of the valuable property by two prospectors returning from a futile two-years' search. Exceptional returns from preliminary shipments bring wealth to the owners and inspire adjacent leasers to active development. W. S. L.

Standardized Cross-Cut Rounds. By Howard Drullard. (E. & M. J., January 3, 1920.)

An illuminating account of improved methods of drilling and blasting at the property of the North Butte Mining Co. The following topics are ably discussed:

1. Adjusting the machine so as to obtain maximum results.
2. Descrimination in the selection of powder for breaking different kinds of ground.
3. Attention to ventilation an important factor in producing results.

Illustrations of the instruction and requisition cards issued to miners working on development headings. Results indicate that a high standard of efficiency has been reached by this company in its drilling operations. W. S. L.

Divide Silver-Gold District of Nevada. By Geo. J. Young. (E. & M. J., January 10, 1920.)

Four general groups of prospects comprise the Divide area which bears a certain geological similarity to the Tonopah district. Description of the general exploration and development methods followed are given, together with mining, supply costs and other data. W. S. L.

METALLURGY.

Differential Flotation of Zinc-Lead Sulphides by Metallizing the Blende. (E. & M. J., December 27, 1919.)

The results of the experimental work of C. C. Freeman, of Broken Hill, on the differential flotation of lead-zinc sulphides are embodied in U. S. Patent 1,301,551, April 22, 1919. Dilute carbonate of soda solution used as a frothing agent was found to give indifferent results, but a great improvement was noted when the zinc sulphide particles had been superficially coated with certain other metals, as copper. The metallizing of the zinc sulphides is the result of electrolytic or other action when copper or one of its salts or a metal electro-negative to copper is in contact with the flotation pulp. Oil, the inventor says, is unnecessary in the first treatment, as it helps to float the blende along with the galena thus fouling the lead concentrate. The process is claimed to be of particular commercial value when the zinc predominates in the ore or mixed concentrate and when removal of pyrite is necessary.

W. S. L.

Electric-Resistance Furnace of Large Capacity for Zinc Ores—II. Operation of Furnace and Characteristics of Process. By Charles H. Fulton.

In this article we have details of the experimental work with electric resistance furnace of commercial size, based on the author's well-known plan of making briquets with the zinc ore to be treated, and using these briquets as resisters for an electric furnace.

The article is well illustrated. Several tables and diagrams are included.

The furnace and process presents the following characteristics expressed in a brief way:

1. It maintains the physical and metallurgical conditions of the present-day retort practice.
2. The energy of the distillation is generaled within the charge itself.
3. It is a large unit furnace. The handling of material will be done by cranes.
4. Probable costs have been calculated which show a marked reduction over present costs.
5. The process can be applied to zinc ores, even to the so-called complex ores.

F. A. L.

Production of Copper from Secondary Material. By Lawrence Addicks. (Chem. and Met. Eng., January 21, 1920).

In addition to the circulating products incident to normal copper refining the plant is often called upon to treat a wide range of metallurgical by-products from outside sources as well as miscellaneous copper-bearing scrap material. The article discusses the methods of sampling miscellaneous products entering the refinery, their treatment in regular or special furnaces, with a discussion of the commercial possibility of recovering some of the impurities as metallic by-products.

F. A. L.

A Contribution to the Study of Flotation. By H. Livingstone Sulman. (The Mining Journal, November 22, 29, and December 6, 7, 1919).

This article, although published in other magazines, is more completely printed from an abstract of a paper read before the Institute of Mining and Metallurgy. It is written in technical form and is very clearly described by sketches and diagrams.

All the questions connected with flotation that the Mineral Separation, Ltd., have made such a success, are clearly brought out by Mr. Sulman. The article is continued in four numbers of the Mining Journal. F. A. L.

A Contribution to the Study of Flotation—III. By H. Livingstone Sulman. (Mining & Scientific Press, January 24, 1920.)

The discussion of the physics of the process continued. The author discusses the dynamical aspect of surfaces, modification of surface characteristics during ore dressing processes and interfacial tension. W. S. L.

Elements of Smelting Plant Design—I. By Oliver E. Jager. (Mining & Scientific Press, January 31, 1920.)

An interesting article, the purpose of which is to explain the method of selecting some of the appliances usually found on a modern smelter, as well as to discuss certain generalities. Only the metallurgical side of the subject, however, is treated. Some of the topics discussed are size of plant required, economics of the problem, effect of local conditions, selection of the process, and the chemical nature of the ore to be smelted.

W. S. L.

A Contribution to the Study of Flotation II. By H. Livingstone Sulman. (Mining & Scientific Press, January 10, 1920.)

A further elaborate discussion of the physics of flotation. The author discusses the molecular constitution of solids and liquids, gravitation and molecular forces, surface energy and surface tension, pressure in bubbles and the dynamical aspect of surfaces. W. S. L.

Experimental Flotation of Low-Grade Quicksilver Ore. By E. G. Stowell and Will H. Coghill. (Mining & Scientific Press, January 24, 1920.)

This paper gives the result of a joint investigation carried on by the U. S. Bureau of Mines, and the Oregon Bureau of Mines. It deals with the experimental flotation and table concentration of a cinnabar ore, containing 0.5 percent mercury. Numerous screen analyses and the conclusions drawn therefrom are given. Table concentration tests proved discouraging. Along with detailed procedure on the flotation tests, methods of grinding and their influence on flotation are discussed. Acidity in pulp was found to be neutralized by grinding in ball mill. The beneficial effects of lime water and fine grinding are enumerated; 90 percent extraction obtained. W. S. L.

OIL.

Petroleum Resources of the World. II. By John D. Northrup. (E. & M. J., January 3, 1920.)

In the second installment of this article the author deals with the commercial control of the petroleum industry by various countries. The names of the companies operating in different parts of the world are given. American, British, and Dutch interests control most of the world's oil. The author states that the United States is supreme in the Western hemisphere, but deplores the lack of an aggressive foreign nationalistic policy similar to other foreign governments.

W. S. L.

Geologic Distillation of Petroleum. By Baily Williss. (A. I. M. E., Jan., 1920.)

In 1882, Peckham put forward a provisional hypothesis to account for the distillation of petroleum. He did not formally state the hypothesis, but discusses facts drawn from many fields. He tried to point out "fractional distillates" produced under high pressure, and consequently at a comparatively high temperature.

The object of this paper is to test Peckham's hypothesis and the contributions to it made by White and Johnson, by considering the geologic activities of Appalachian province in the light of the present-day knowledge. F. A. L.

The Petroleum Resources of the World. I. By John D. Northrup. (E. & M. J., December 27, 1919.)

The basis of this article was issued in mimeographed form for Government use only, and after the armistice, the remaining copies were released to the general public. The article summarizes briefly and concisely information relating to

1. Geological strata in which oil is found.
2. Geographical distribution.
3. Future prospects in various countries.
4. Political control of the present production. W. S. L.

bout was very fast and both men displayed much science.

Fifth match, 145 pounds—Won by Serefinni, Mines, over Daywalt, C. C., who got a decision in 10 minutes with no fall. Serefinni confined himself mostly to the scissors and head holds. The men were very fast.

Sixth match, heavyweight—Won by R. C. Crawford, Mines, who threw Brumfield, C. C., in 9 minutes. Brumfield played in rather hard luck. He attempted to head spin out of a head hold, but got too close to Crawford, his shoulders striking his opponent's body. Crawford fell on Brumfield, and was given the verdict.

Seventh match, 158 pounds—Won by Elliott, C. C., who threw J. W. Crawford, Mines, in 7 minutes with a head and scissors hold. The going was decidedly fast and quite rough. Crawford was severely punished, and it took ten minutes to put him on his feet.

Eighth match, 145 pounds—Senning, C. C., was given the decision over Thompson, Mines, in 10 minutes with no fall. Senning was the aggressor all the way through, and was given the verdict because he was the top man for 45 seconds.

Ninth match, 108 pounds—Won by Denisteind, Mines, who threw McCool in 9½ minutes with a head hold. Denisteind was caught in several tight places, but managed to either bridge or head spin to safety.

The Mines scored another boxing and wrestling victory for itself. In its meet with the University of Colorado they won six out of ten matches. Two were a draw and two matches were won by Boulder.

The surprise of the evening was when Ferguson, of Colorado, won the decision over R. F. Crawford, of Mines in the heavyweight wrestling. Crawford won the heavyweight championship of the D. A. C. Tournament last week in Denver.

Salisbury, of Colorado, lost to Watkins, of Mines, on a decision in the welterweight boxing, while Trinnier, of Colorado, and Clothier, of Mines, boxed to a draw in the middleweight boxing class. Levings, of Mines, defeated Fineberg, of Colorado, in the bantamweight boxing, on a decision. Adamson, of Mines, defeated Pringle, of Colorado, in two rounds in the featherweight boxing, and Weiss, of Colorado, and Strock, of Mines, boxed to a four-round draw in the lightweight division.

Serefinni, of Mines, defeated Weber, of Colorado, by a fall in five minutes in the 145-pound wrestling. Weber was substituted for Coleman just before the match.

G. W. Crawford won over Fulgum, of Colorado, in the middleweight wrestling by a fall in 11 minutes. Kay, of Mines, defeated Chapin, of Colorado, in the featherweight wrestling by a decision. Lovelace, of Colorado, defeated Thompson, of Mines, by a decision in the 135-pound wrestling.

All of the wrestling events were scheduled ten minutes, and the boxing contests were scheduled for three rounds.

A wrestling contest has been arranged with D. U. sometime early in the Spring. This will give Mines its third appearance at this branch of sport. The game has proved very popular this Winter. It is more than likely that boxing and wrestling has come to stay.

School News

ENROLLMENT AT THE SCHOOL.

The second semester commenced on January 12th, with atotal of 335 students enrolled. Seventy-six scholarships were cancelled and only 135 freshmen are left out of 199 that completed the first semester.

The Colorado School of Mines is giving the following popular lectures on Petroleum Technology:

Wednesday, February 4—I. The Fundamental Principles of Oil Geology (Part I). By F. M. Van Tuyl.

Wednesday, February 11—II. The Fundamental Principles of Oil Geology (Part II). By F. M. Van Tuyl.

Wednesday, February 18—III. The Composition and Properties of Oil and Gas. By F. M. Van Tuyl.

Wednesday, February 25—IV. The Origin and Occurrence of Oil and Gas. By F. M. Van Tuyl.

Wednesday, March 3—V. The Methods of Prospecting for Oil and Gas and the Development of Oil Fields. By F. M. Van Tuyl.

Wednesday, March 10—VI. The Oil and Gas Fields of North America and Wildcat Territory of Promise. By F. M. Van Tuyl.

Wednesday, March 17—VII. The Origin, Occurrence, and Distribution of Oil Shale. By F. M. Van Tuyl.

Wednesday, March 24—VIII. The Future of the Oil Industry in North America. By F. M. Van Tuyl.

Wednesday, March 31—IX. The Refining of Crude Petroleum. By A. H. Low.

Wednesday, April 7—X. The Production and Refining of Shale Oil. By A. H. Low.

The lectures will be given in Simon Guggenheim Hall at eight o'clock on the evenings of the dates announced.

VOL. X MARCH, 1920 No. 3

COLORADO SCHOOL OF MINES MAGAZINE

THE COLORADO SCHOOL OF MINES ALUMNI ASSOCIATION, PUBLISHERS, GOLDEN, COLO.

The Status of Gold*

(By Col. Chester T. Kennan.)

It is now universally conceded by bankers and financiers the world over that gold can never again circulate as money at the old gold standard price, $20.67 plus per fine ounce.

Therefore, the only alternative now presented is to establish a new gold standard or forever abandon the use of gold money and gold standard.

The use of gold money has already been abandoned for several years last past and if that abandonment is to forever continue, then in all conscience the greatest governments of the earth—especially those of England and the United States—should immediately make public proclamation of the fact, We say, especially those of England and the United States because the British Empire and the United States make nearly 90 per cent of the total annual production of gold and themselves have the bulk of the world's available supply and are, in fact, all-powerful in this all-important matter affecting the whole world in general, but most vitally their own citizens.

Abandonment Would Cause Chaos.

If announcement were made by these governments today that the use of gold money is definitely and permanently abandoned, then, by tomorrow, as a matter of course, every gold mine in the world would be closed down and abandoned as useless and worthless property, because there is already an abundance of gold for use in the arts exclusive of its use for money. Such announcement would, by the stroke of a pen, deprive the world's gold miners of billions of dollars' worth of property, close down forever one of the world's oldest and most important industries, gold mining, and at the same time deprive the world of the use of gold money and a gold standard; and such an announcement would further necessarily include the total repudiation of gold payments—in such case, none of our Liberty Bonds or other national obligations made payable in gold could be paid in gold—not even the interest. Any government intending, or projecting, or passively permitting, such a future for gold and which would not forewarn its citizens of such impending financial cataclysm, would not be worthy of the name, government. If such financial calamity is now in store for the citizens of this Republic, then certainly the citizens have a right to be so informed now.

New Gold Standard Necessary.

On the other hand, should these governments now establish a new gold standard by simply acknowledging, and stamping upon gold its present true value for all the legitimate uses and purposes of mankind in a modern world, then every gold mine in the world would be much enhanced in value, the gold mining industry would flourish as never before, and to mankind would be restored the time-honored blessing of gold money and a gold standard of value.

While to deliberately render useless and worthless billions of dollars' worth of gold mining property and, at the same time, deprive the world of one of its oldest, most important, and most honorable industries, would be a scandal of inconceivable foolishness, yet the resultant confusion, financial chaos and endless misery that would be inflicted by depriving the world of its gold money and of its gold standard of value, would be infinitely more disastrous to modern civilization and world-progress.

The accumulated experience of mankind has long since proven beyond cavil the preeminence of gold as real money and also its unequaled superiority as a standard of value.

Whole World on Gold Basis.

Although a gold standard had long before been in practical usage in England, the act of Parliament in 1774, limiting the legal tender of silver coins to £25, was virtually the official adoption of the single gold standard, though nominally the single gold standard was adopted in 1816. The single gold standard was adopted by Portugal in 1854, Germany 1871, United States 1873. Scandinavian states 1874, Holland 1875, France and the Latin Union 1876, Austro-Hungary 1892, British India 1893, Japan 1898, Russia 1899—virtually the whole world went on to a single gold standard before the present century.

Essentials of Real Money.

In a loose sense of the term, anything may be called money which, for a time, serves as a common medium of exchange, but real money must possess in the highest degree attainable the following qualities and attributes of wealth. It must be useful; must be durable, not easily susceptible of change, corrosion, or decay; must have high value in small bulk; its value must be easily recognizable and conveniently transferable; must be divisible without appreciable loss into any desired units; must be uniform quality throughout so that one one unit equals another; must be of the most stable value and must be limited in supply.

Gold, by natural law, is the world's

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* Reprint from Northwest Mining Truth.

money. As the essence of government is force, so the essence of money is gold.

Gold History Is Civilization's.

The history of gold is concurrent with history of civilization of the human race and gold has ever been civilization's most constant companion and able ally. In civilized and half-civilized nations there never was a time when gold in the hand would not buy meat for the belly. There never was a time among civilized or half-civilized nations, when gold was not more desired for what it would procure than for what it is in itself—any commodity is worth what it will exchange for and as gold can always purchase anything and everything, it is an object of universal desire, which is a prime requisite of money.

Functions of Money.

Fundamentally, the three great functions ("money work") of money are to serve as—

(a) A medium of exchange;
(b) A measure of value;
(c) A standard of value, or, as often expressed, a standard of deferred payments, and this third function is of the greatest importance—the standard of value implies the estimation of value at different times, while the measure of value contemplates its estimation at the same time.

The superior stability of gold as a standard of value is attained through both natural causes and artificial means. Gold is so distributed in Nature that the amount which can be won from the earth in any one year is small in comparison to the total stores of gold already in use by humanity, and sudden fluctuations in supply are thereby precluded.

Gold Volume Must be Sufficient.

Manifestly, the quantity of gold, that is to say, the effective gold power, must be sufficient to enable it to function as a medium of exchange and also as a sound basis for other mediums of exchange, such as a reasonable and proper amount of paper currency, i. e., to maintain the paper on a par with gold coin; and also enough to guarantee the payment in gold (if demanded) of all instruments specifically made payable in gold.

Effective Power of Gold.

Effective gold power may be increased in two ways: First, by humanity, in the regular course of business, placing a higher value per ounce upon it, and second, by wresting greater supplies from Nature. The former method has its practical physical limit at making coins of gold too small in size for convenience in usage. To make our $5 gold piece half its present weight would be a coin as small as really practicable.

Legislation does not fix the value of gold. It merely acknowledges (stamps it) the value placed upon it by humanity. Manifestly, and from the very nature of things, the precise value of gold at any given time for all the uses and purposes of mankind can never be fixed by law with mathematical or scientific exactitude; but notwithstanding that fact, for uniformity and convenience sake and to avoid intolerable confusion, and for the steady maintenance of gold stability and usefulness as the world's medium of exchange and standard of value by which men can be guided in their immediate and future commitments, we must give it a certain fixed standard value by law, which standard value should be, as nearly as human prescience can calculate, the approximate value that humanity would place upon it, in the absence of such law, say, for the next 25 years or more. And quite naturally, too, the standard must be adjusted from time to time to meet violent and cataclysmic changes in world-conditions—most emphatically such as were wrought by our recent world-war.

Present Status of Gold.

The chief and outstanding facts concerning gold at the present time are substantially the following:

Upon commencement of the world-war all men foresaw that there would not be enough available gold at the then standard of value per ounce to pay the vast war-obligations which must naturally be incurred by belligerent nations and consequently gold must greatly increase in value, become the dearest money, retire from circulation and be hoarded. All of this happened over night, as it were, in the British Empire, and the other nations quickly followed suit. In the words of Frank A. Vanderlip, who has personally made study of Europe's economic status, "England itself in the first days of the war had to resort to a flat issue by the government. Gold, which was the general medium of exchange aside from the Bank of England notes, disappeared from circulation over night."

All men blessed with the faculty of thinking and reasoning logically foresaw that the world would be compelled to take advantage of both the above mentioned methods for increasing the world's effective gold power, that is to say, by establishing a new gold standard of value per ounce, and thereby greatly increasing the world's gold production. But how long the war would last and how great a burden of governmental indebtedness it would become necessary for the nations to incur was not, at the beginning of the war, given to human intelligence to foresee. In the very nature of things it was necessary to wait till the war was over and the battlefields "mopped up" before taking invoice of stocks and casting up balance sheets to ascertain at what figure the new gold standard must be fixed to accomplish sane and methodical "reconstruction" and resumption of industrial progress and national prosperity.

Two Hundred Billion War Debts.

It is now estimated that war obligations incurred by belligerent nations on account of the recent war will be in excess of $200,000,000,000; while the total available gold in the world is now about $9,500,000,000, and a very small part, indeed, of this $9,500,000,000 would be available, in any case, to pay interest on the indebtedness incurred during and on account of the recent world-war, as most of that part of the $9,500,000,000 which is in possession of the governments was previously otherwise engaged—for instance the United States, which is best supplied, is estimated by the last month, July, Federal Reserve Bulletin to have the following items of gold coin:

General stock in the U. S...	$3,092,037,669
Held in the U. S. Treasury as assets of the gov't....	367,801,295
Held by or for Federal Reserve Banks and Agents..	1,539,887,136
Held outside the U. S. Treasury and Federal Reserve system	389,647,007

Of this gold, $1,333,000,000 is in the Federal Reserve Gold Settlement fund and about $822,000,000 the basis for our outstanding gold certificates; and there is outstanding more than $2,500,000,000 Federal Reserve Notes "redeemable in gold on demand at the treasury department of the United States"—so that if Uncle Sam, himself, had in his own vest pocket all of $3,092,037,699 (which he hasn't by a long shot) he wouldn't think he had "such a much."

Suspension is Repudiation.

So much, anyway, for the smug boasters about "our great stock of gold"; and as for the imbecile chatter that we have "call" besides on all the gold of all the other nations—every sane man knows that practically speaking we haven't a "call" on even one single gold dollar of any other nation. Every nation under the gold standard has been forced to repudiation of gold payments—or in more polite and diplomatic language have suspended gold payments. None of the belligerent governments has sufficient, nor anywhere near sufficient, gold to even pay the interest on its war-obligations. No government dares to pay out a dollar in gold now, because, if it did, it would never get it back—except by paying a great premium. Any government that would now consent to pay its debts in gold at the old standard value would be stripped of every gold dollar within an hour. Any government which would be so foolish as to pay out its gold now at the old standard value per ounce would suffer impeachment by its citizens, because its citizens have a right to expect, and do expect, their government to hoard its gold store until the new gold standard is established when the effective gold power of their government will be enhanced from 60 to 100 per cent, according to the point at which the new gold standard is established between $33 and $40 per fine ounce.

Gold Not Money Now.

At present gold is not money. It is not in circulation. It is not performing any of the functions of money whatever. It is not a medium of exchange. It is not a measure of value. It is not a standard of value. Gold will not again circulate as a medium of exchange, nor be money, until a new gold standard is adopted.

And to this strange and unprecedented impasse have we now arrived.

That the world should be deprived of its gold money and a gold standard for any great length of time is unnecessary, monstrous, and unthinkable.

Lack of Standard Disturbing.

The evil effects of cutting entirely loose from gold money and a gold standard, and floundering around in business without any standard of value at all to guide men in commerce, are boldly apparent and painfully impressive in our present state of confusion, unrest, and constantly soaring prices, such prices being chiefly due to the fact that, in the absence of any standard of value and in the presence of only fiat currency, men feel sure of a profit only on a constantly rising market.

Gold Out of Circulation.

When a business man can take his greenbacks or federal reserve notes to the bank and get the gold for them any time he chooses, then he knows just where he is at and can readily calculate just where he is going to and exactly where he is coming out in his business affairs. But when our business man takes his federal reserve notes to the bank and asks that they be exchanged for gold, and the cashier says, "Nix, No gold in circulation now, never going to be any more gold in circulation, no matter that your bills read on the back 'Redeemable in gold' they can't be redeemed now in gold," and that blythe cashier naively adds, as he usually does, "Most likely they never can be redeemed in gold"—then our business man quite naturally does not know where he is at, nor can he calculate where he is going to, nor where he is coming out in his business. He doesn't know whether the unchristian rise in prices is due to depreciation of the paper currency or some other more mysterious cause. Frightful apparations of towering mountains of flat currency, wild cats, shinplasters, and Carranza money haunt his dreams by night and torture his brain by day. He is seized in the clammy grip of that ghastly cadaverous feeling which quivers the trembling frame of one lost alone in the desert and makes his chilling flesh creep on his very bones. And, when he prays, he does not know whether he should turn his face towards Washington, Wall Street, or Bolshevik Russia—of the trio Washington seems the most indifferent to his ultimate fate.

What doth it profit a mighty nation to have all the gold in the world and never use a dollar of it?

Our Money Quota is Small.

We have by far the smallest circulation of money per capita of any of the belligerent nations. With our $3,092,037,699 gold coin, and $822,000,000 gold certificates withdrawn from circulation, as it is, our circulation per capita today is less than it was before the war. Yet, as the only panacea for our financial ills, there was introduced in Congress, just the other day, a resolution looking to the "contraction" of our "inflated" currency. Mr. Vanderlip also says, "The chaos in the circulating medium is enough to make Europe seem like an economic madhouse." In the light of such a "resolution," introduced in the greatest lawmaking body in all the world, we are led to wonder what good, old Anglo-Saxon nouns and adjectives Mr. Vanderlip has left over to fittingly characterize our own economic madhouse. To the business man up a tree that "resolution" sounded like a mocking stanza from "The Mikado" comic opera or the "Pirates of Penzance."

New Standard Vital Necessity.

In the total absence of any standard of value to go by, men naturally distrust the immediate as well as the more distant future. The very air they breathe seems surcharged with mysterious financial perils. They intuitively realize that our financial fabric now rests upon shifting sands and nothing is firm or fixed. They are swayed by total lack of confidence and filled with apprehensions and misgivings and withal an overwhelming doubt as to whether reconstruction is to take place through orderly process or to be built up on the wreckage of financial world panic. The monetary situation is momentarfly such that the latter dread denouement is certain—unless congress takes speedy action to establish a new gold standard. The fixing of a new gold standard is necessarily the first step in orderly process of reconstruction. We are now drifting aimlessly on tempestuous seas of finance with no fixed standard of value, no monetary standard at all—truly we are aboard the phantom ship under stormy skies without chart, rudder or compass.

It is idle to talk of stabilizing industries and commerce in this country until we stabilize our dollar; and the dollar can be stabilized only by establishing a new gold standard at a price for gold at which such standard can be steadily maintained in all its proper functions under world- conditions widely and permanently changed from those prevailing before the war.

Old Standard Broken Down.

The "conscientious objector" to the establishment of a new gold standard is now just as conscientiously wrong and pusillanimously conceited as he was in refusing to fight in protection of his home fireside. He rolls his eyes skyward and with hypocritical meticulosity proclaims that because the country has issued bonds payable in gold of the old standard value, therefore to establish a new standard at a higher rate would be "repudiation"; and he pretends not to see that every one of the belligerent countries has long since been forced by the exigencies of war to "repudiate" payments in gold at the old standard value and that payment by them of their war obligations in gold at the old standard value is humanly absolutely physically impossible. Not one of the belligerent countries has sufficient gold power at the old standard to even pay the interest on its war obligations.

Now let us see what are the rock bottom equities:

To start with, no equity court in Christendom would decree the performance of an absolute impossibility—and for the simple reason that "all the king's horses and all the king's men" could not execute the decree.

People and Government One.

The superficial view is all too common that the people and government of this nation are separates. The people and government of this nation are in essence one and inseparable. There are over 20,000,000 government bondholders in the country now—the equivalent of one bondholder for every family in the nation. Our citizens individually contributed to a common "pot" for a common purpose equally dear to each and with the general understanding among ourselves that these contributions were some time to be returned to each with interest. In other words, we individually made a loan to ourselves collectively and collectively we will pay it back to ourselves individually with interest. If each man receives value equivalent to the value he contributed and interest, that is all he expected, all he desired, and all he could ask for in equity. If he contributed $20.67 when gold was worth $20.67 per ounce and at the time he receives payment two-thirds of an ounce of gold is worth $20.67 and he receives two-thirds of an ounce of gold and interest on $20.67, that is all he could reasonably ask, all he does ask, and all he should have in equity.

If there is a man in this broad land who dares to charge that any one of us bought a Liberty Bond with the purpose or intent of gouging our country—let that man, if he can be called a man, step forth and face the firing squad tomorrow morning at daylight.

New Standard Not Less Than Cost.

During the last five years gold has greatly increased in value owing to its startling scarcity by reason of the world's sudden and vastly increased necessities for its use. In view of the great amount of gold which must be dug within specific time the new standard price per ounce certainly cannot be less than its cost of production. Manifestly the production of sufficient gold to maintain a gold standard. But dear Old England is too "sot industry. Gold miners have dug, and in that sense have produced, all the available gold we have in this world up to date, and we must necessarily look to them, and to them only for all the new gold we need now and in the future. As the only men qualified to that end it is properly up to the gold miners to now specify what means it is necessary to employ to make this vast increase in gold production. It is for the gold miner to estimate how much it will cost per ounce to produce an adequate supply of gold within the time requisite—and that cost price per ounce with reasonable profit included must be the new gold standard. The general concensus of opinion of gold miners the world over is that the new mint price for gold should not be less than $33.33⅓ per ounce of fine gold; and that if the gold standard were now adjusted at that price they could produce an adequate supply within that time to steadily maintain such standard in all its proper functions. In a general way it is estimated that to maintain such a standard the annual production of new gold must at the very least be double what it was before the war. The open market price for gold in the great money centers is not much below $33.33⅓ per ounce and would be higher had not that figure been quite generally understood to be the estimated minimum price at which gold miners could produce the requisite gold to maintain a gold standard.

Re-Stamping Would Increase Power.

Therefore, calling into the treasury all our gold coin and restamping it at $33.33⅓ per ounce would now increase the effective gold power of the nation about 64½ per cent, or $1,994,364,215, which would be enough to enable gold payments to be resumed; our paper currency would again be on a par with gold; we would again have a gold standard operating successfully in all its functions; we could pay interest on our bonds in gold whenever called for; and as the installments or principal falls due on those gold bonds we would have enough new gold to pay them in gold, also whenever gold would be called for.

Since the war began about five years ago and gold went out of circulation over night, no sane person has entered into a contract payable in gold and consequently it is not apprehended that many individuals would consider themselves in any manner injured by the establishment of a new gold standard at $33.33⅓ per fine ounce.

However, whenever any world-wide or nation-wide program is carried through, no matter how beneficient it may be on the whole, certain individuals are bound to be injured or imagine they are injured —that cannot be avoided, it is inevitable. But when, for the good of the whole, a program must be carried through at all events, these individuals must be considered as accidental or incidental unfortunates, who cannot be allowed to stand in the way of the world's or nation's legitimate progress and manifest destiny.

All Nations in Same Plight.

All the belligerent nations are in the same financial plight that we are, only worse. but as the British Empire and the United States are by far the greatest possessors and greatest producers of gold, the other nations are naturally with deference waiting for them to take the lead in the establishment of a new gold standard. But dear Old England is too "sot in her ways" to cut loose and take the lead in such a matter and it will therefore be necessary to start the ball rolling by the introduction of a bill in our congress for that purpose, when England would be very quick and pleased to act in concert and the other gold-standard nations would gladly join in.

U. S. Must Blaze the Trail.

Under all the prevailing circumstances at the moment, the United States is the most influentially powerful nation on this globe, and the balance of the nations are now looking to her in this dark world crisis to show the way and "blaze the trail."

Some Notes on Mining Conditions in Costa Rica, Central America

By H. H. Juchem, '10.

Labor.

The production of gold and silver declined very materially because of scarcity of labor. This scarcity is due, not to any maximalistic, or even socialistic trouble as in other parts of the world, but to a perfectly normal result of greatly increased production of agricultural products.

Before 1916 a great proportion of the food stuffs of the country were imported, importation which was offset by the exportation of bananas, coffee and cacao. The importation of foodstuffs and even of the necessities, which had not been produced in Costa Rica before, were practically cut off. At the same time the export of coffee, bananas and cacao was affected in about the same proportion. The situation became acute; it was either ample production of the necessities formerly imported, or starvation. Prices on agricultural products jumped. Later sugar, beef, vegetables and grains of all kinds had to be supplied to the Canal Zone. Prices advanced further. So far as mining is concerned the effect was a scarcity of labor available, since most of the native Costa Rican miners immediately took to agriculture. The remaining had to be paid more money for less labor than they had been doing before. The foreign miners, Hondurenians, Nicaraguans, Salvadoreninans drifted out of Costa Rica because the wage scale in the other countries was very much higher than the traffic in Costa Rica could bear.

In 1919 the political trouble under the iron hand of the dictator, who had taken the country over in January, 1917, broke out in a revolution and invasion of Costa Rica by expatriated Costa Ricans commanding a mixed body of Nicaraguans, Hondurenians and Costa Ricans. The dictator immediately began to recruit men from laboring classes. It is true that few miners or employees of American companies were taken away, but the same old effect of miners going to the fields to take the places of farm laborers further aggravated the labor scarcity in the mines and lowered the efficiency of the miners remaining. At present all political troubles appear to be over, but the labor scarcity still exists and bids fair to hold for some time for the following reasons:

1. Expansion of ordinary agriculture due to prevailing high prices of foodstuffs.
2. Expansion of agriculture in coffee, sugar and cacao due to high prices.
3. Exodus of negro labor from Atlantic side to West Indies, especially Cuba, Jamaica. Native labor has to replace this.
4. Exodus of foreign miners to the other Central American countries.
5. The dictator's troops returned full of dysentery and malaria and will be unfit for production of any sort for some time. The revolutionary troops on the other hand, held that a patriot who has risked his life should not have to work —so they don't.

There were strikes with various objects in view at La Union and at Abangarez.

Taxation.

During 1917, 1918 and 9 months of 1919 taxes on gold and silver production have amounted to 10 to 15 percent of the value of the gross production, depending on rate of exchange. For one mine, 4 percent; for another, 1 percent; for another, nothing, depending upon the concessions granted to one or another of the mines and in other cases upon the standing of the mine with the dictator. With the overthrow of the dictator the tax was fixed at 3 percent of gross production of bullion plus the obligation to sell the government New York funds corresponding to 15 percent of the gold content at a rate 20 points under the current rate of exchange. At the present exchange this amounts to a little less than 4 percent of the value of the gross production. Under the concession of the Abangarez Gold Fields, 1 percent of the gross production is paid.

Aguacate Mines.

The Aguacate Mines, in the heart of the Agricultural District, suffered more in proportion from the scarcity of labor than the other mines. The tonnage produced in 1919 was less than in 1918, and of lower grade. The net profit was, nevertheless, greater than in any previous year except 1917.

The greater net earnings were due to the reorganization of the staff, a changed mining system, economics in mining, milling and cyaniding, closer control of all operations, and rearrangement of flowsheet in mill and cyanide plant. The lowering of costs due to above causes have brought into the class of commercial ore a great deal of ground which was unprofitable under former conditions.

Ore reserves were increased in spite of adverse conditions and lack of labor available for development. All the ore produced came from the Quebrada Honda Mine.

Ore has been developed beyond both the north and south limits of the orebody as known heretofore.

It is proposed to make available a still greater quantity of material not now classed as profitable by a simple modification of the treatment.

Abangarez.

The production of Abangarez Gold Fields has averaged $600,000 yearly for the last five years. This has been lowered to about two-thirds of this amount in 1919, on account of scarcity of labor and an unexpectedly low result from ore reserves in the Tres Hermanos Mine.

The Abangarez Gold Fields is reported to have acquired the La Luz Mine and several other properties on their concession and near it. The La Luz property will be connected with the Tres Hermanos by a 5-mile narrow-gauge railway and 4,000-foot aerial tramway. The La Luz vein, though narrow, is expected to produce comparatively high-grade ore, which, combined with the ore now being produced in Tres Harmanos, is calculated to bring up the average mill heads to $8.00 per ton; $135,000 worth of ore has been blocked out in the La Luz vein to date.

Little development work has been done in Tres Hermanos mine during the past few years, as was the case in the other mines of the country. As a consequence, the reserve of fully developed ore of present mill grade is rather low. On the other hand, there are a great many known lower grade bodies of free milling ore which are now being developed at depth.

Esparta Gold Fields, Ltd.

Has been developing the Santa Clara Mine near Esparta. Several bodies of ore of fair grade have been found, together with two small bonanzas. The property includes several veins of from a few inches to several feet in width, the values varying about in proportion to the width of the veins. A 20-stamp mill was purchased and 5 stamps put in commission. Little ore was milled as most of the values were going over the tail end of the plates. An attempt was made at cyaniding, but with little success. The trouble is obviously a lack of experienced technical men.

Manganese.

During the war the peninsula was thoroughly prospected for manganese. Two concerns, the Costa Rica Manganese & Mining Co., and The Nicoya Mining Co., were the only producers of consequence. The latter produced 2,000 tons in three years' operations, and closed down at end of the war, selling their ore on hand to the former named company.

The Costa Rica Manganese & Mining Co. opened up workings at Playa Real, on the peninsula of Nicoya, and produced 14,000 tons of very superior grade ore, before its exhaustion. After Playa Real was exhausted operations were transferred to Curiol, 15 miles inland, near Santa Rosa. The surface extent of the latter deposit is much less extensive than that of Playa Real. Up to June, 1918, the Curiol property had produced 20,000 tons of ore, averaging 52 percent manganese and 8 percent silica, and worth approximately $60 per ton at war prices. The ore was hauled from the mine by motor trucks, and a 5-mile narrow-gauge railroad. Since June about 500 tons of high-grade ore have been mined monthly. There are in reserve more than 20,000 tons of ore blocked out.

Several other prospects, among them El Tamarindo, are reported to be very promising.

The fate of these manganese properties lies with the ferro-manganese market. At present prices it is not practicable to ship anything but the richest grade of ore, and in these, as in most mines, the proportion is small.

La Union.

Conditions at La Union Mine of the Costa Rica Mining Co., are reported to be most favorable, except for the labor scarcity. Development is now progressing satisfactorily and good ore has been reported. The mine is one of the steady producers of the country.

FORTIETH ANNIVERSARY OF GEOLOGICAL SURVEY.

The fortieth annual report of the United States Geological Survey, Department of the Interior, just made public, compares the present scope of the work with that of the work done during the first year of this organization. The growth of the Survey is suggested by a comparison of the appropriations for the present year, which comprise items amounting to $1,437,745, with the total appropriation of $106,000 for the first year, 1879-80. During the 40 years the number of employees has been increased from 39 to 967.

New Radial Type Loader for Rapid and Economical Loading of Loose Materials

In recent years the increasing use of sand, gravel, crushed stone, ashes, slag, etc., for road building, concrete work, and other purposes, as well as the increased storage of coal and coke, has caused the handling and re-handling of immense quantities of loose materials.

During the time that help was plentiful and cheap, the prevailing method was to use a gang of laborers to shovel materials from ground storage to wagons or trucks. However, the constantly increasing cost and acute shortage of labor demanded the substitution of mechanical handling machinery to replace the old expensive and laborious "hand shovel" method.

To meet this demand the Jeffrey Self-Propelling Loader was brought out about ten years ago, after extensive experiments and tests and careful study of the then existing conditions, being the first machine of its kind to be placed on the market, and has proved a remarkable labor saver and quick handler of materials.

It has been used with great success by hundreds of leading concerns, but in order to meet developments in the various industries and the constantly changing conditions, the Jeffrey Company has developed an improved design known as the Radial Loader, which overcomes all the objections of the old type of machine, and is the last word in design and construction.

Showing the small radius in which the Type K Loader will operate; a feature which enables the machine to turn in congested places or around a corner.

Type K Radial Loader used for handling material from storage pile to railroad cars. The swivel chute makes it convenient to distribute material over a greater area of the car without moving the loader.

Self-Feeding Into Pile.

There is a great advantage in having the loader feed itself into the pile over other methods of hand shoveling or using a special mechanical device to pull the materials in front of the buckets. The greatest objection to the old 4-wheel type of Self-Propelling Loader was its inability to feed into the pile.

Three-Wheel Construction.

The three-wheel construction of the Jeffrey Radial Loader enables it to move backward and forward along straight lines into a pile of material or to cut wide swaths across the face of a pile by swinging alternately upon its driving wheels as pivots, which action is obtained through the use in its driving unit of a set of differential gears, the same as in an automobile, whereby the driving wheels act in conjunction with or independently of each other.

As noted in Figure (1), (Neg. 11291), by turning the steering wheel at quite an acute angle to the driving wheels, the discharge chute will remain practically stationary at the center of the circle while the pick-up end of the extending elevator boom will travel in a circular

Loading direct from hopper bottom car into motor truck. Here a railroad tie has been removed and an extra man placed in the car to feed the material through the hopper doors.

path or by alternately reversing the propelling prive, the loader will oscillate back and forth in an arc. If the steering wheel is gradually turned through a few degrees either way from the above circular path, the whole machine, while cutting from right to left in an arc will gradually move forward into the pile, allowing full range of the machine. This illustration also shows the small radius in which the Jeffray Radial Loader will operate.

Other Advantages of the Radial Loader.

The Radial Loader is designed to handle heavy materials such as crushed stone, sand, gravel, coal, etc. The large wheels enable it to pass over soft, rough or uneven ground, and it will rigidly maintain its equilibrium under all conditions of ordinary rough storage ground or floor. The quickly adjustable loading boom makes the loader an ideal clean-up machine on both smooth and rough ground.

Buckets are designed for heavy service; 14-inch by 10-inch Heavy Malleable Iron Buckets with renewable Digger Edge Steel Teeth riveted on front lips and ends protect it from wear.

The Speed Feature.

The Radial Loader has a fast speed of 60 feet per minute for traveling from pile to pile and a slow speed of 4 feet per minute for feeding into the material. Experiments have shown that a two-speed machine is absolutely essential to obtain the greatest result with the least labor.

Capacity of the Radial Loader.

One cubic yard per minute. Will load crushed stone, maximum size pieces, through 2½-inch ring; maximum size coal, 6-inch lumps.

The Radial Loader is equipped with either Electric Motor or Gasoline Engine. Skilled labor is not required for its operation, and all controlling levers are in plain sight and in easy reach of the operator.

Figure (2) (Neg. 11400), Radial Loader handling material from storage pile to railroad car. The perfect swiveling chute makes it convenient to distribute material over a large area of car without moving the loader.

Figure (3) (Neg. 11428), leading direct from Hopper Bottom Car into Motor Truck. An extra man has been placed in car to feed material through the hopper doors.

Leasing Fight Ended

Washington, D. C., February 3, 1920.

The fight waged in Congress since 1912 to establish federal control of public land policies was ended today when Senate Bill 2775, with many amendments, was reported out of the Conference Committee, a "much rewritten" measure, but finally acceptable to all members of the committee which has haggled over details for many months.

The last item to stall the committee after agreement had been "reached" on Monday of this week was in Section 19, last paragraph, which was finally adopted, reading:

> "All permits and leases hereunder shall inure to the benefit of the claimant, and all persons claiming through or under him, by lease, contract or otherwise, as their interests may appear: Provided, that no claimant acquiring any interest in such lands since October 1, 1919, shall secure a permit or lease thereon under this section."

The bill provides that 10 percent of all money received from sales, bonuses, royalties, and rentals, excepting those from Alaska, shall be paid into the Treasury of the United States and credited to miscellaneous receipts. The final division of royalties as agreed upon was as follows:

To the State, 37½ percent.

To the U. S. Reclamation Fund, 52½ percent.

To the Treasury of the U. S., 10 percent.

These items were the result of a long-drawn-out fight and a compromise. The bill provides no maximum royalty; minimum royalties only having been fixed. The maximum royalties are left to the discretion of the Secretary of the Interior. The compromise measure provides that the total amount of royalties to be paid shall be determined by competitive bidding, and the maximum is fixed at 3,200 acres for oil lands, 2,560 acres for coal, with a maximum of 5 cents per ton for coal. The maximum acreage for phosphate and sodium lands is the same as for coal, while the oil shale provision fixes the maximum acreage at 5,120.

Land Policies Reversed.

The bill is a complete reversal of the

(Continued on page 58.)

TECHNICAL REVIEW

GENERAL.

Mr. Hoover's Address as President of the American Institute of Mining Engineers on February 17, 1920. (February 28, 1920.)

The interest of engineers in national affairs is pointed out. Inflated credit, the return of railways to private operation, and the demobilization of the cargo fleet were all mentioned. The problems of industry and industrial relations, and our social philosophy, were mentioned. The solution suggested was a middle course, dominated neither by the "interests" nor by radical socialism.

W. S. L.

Gold Mining in California. By George J. Young. (E. & M. J., February 14, 1920.)

This is a review of gold production and an analysis of existing statistics dealing with the industry in California, where gold mining has continued since the "Days of '49." The statistics show that gold dredging, drift, placer, and hydraulic mining are decreasing. The greatest production comes from deep-seated ores, refined by amalgamation. Difficulties endured during the war are disappearing and the future now depends on freedom from strikes and increased labor efficiency.

New Mining Control in Ontario. By J. V. Tyrrell. (E. & M. J., February 14, 1920.)

The writer gives an account of the coalition government of farmers and labor representatives which created such an unusual situation in the administration of the business of the Department of Mines of the Dominion Government. The United Farmers Party elected so many representatives that with the help of the Labor Party they were able to control the government. A locomotive engineer became Minister of Mines, while the health of the Dominion was entrusted to a former broom-maker. The most important part of the article sets forth the needs of the mining industry in Canada.

W. S. L.

The Bunker Hill Enterprise. By T. A. Rickard. (M. & S. P., February 21, 1920.)

In his fifth article on this subject Mr. Rickard deals with the geology and mineralogy of the lode. The prevailing formation is quartzite forming part of the belt group of the Algonkian System. Descriptions of the lode by F. L. Ransome and F. C. Calkins of the U. S. T. S., and J. R. Finlay, are added. Oscar H. Hershey contributed maps of the region, identification of the faults and formations, and a hypothesis of the ore deposition. The account ends with a paragraph on the mineralogy of the lode. W. S. L.

Mining Exploration. By J. H. Farrell. (M. & S. P., February 21, 1920.)

The opening of this article is a criticism that discovery and development in the West are not keeping pace with the depletion of mines. The writer continues to state that most exploration companies do their exploring in offices in New York. He maintains that reports of the U. S. G. S. are out of date, and practically useless to the prospector. The remedy suggested is greater personal incentive and more digging. W. S. L.

Conservation of Timber Necessary to Profitable Mining. By Kurt C. Barth. (The Mining Congress Journal, January, 1920.)

The mining industry still lacks proper appreciation of the very important part which timber plays in the production of ores and coal. In spite of strenuous efforts to awaken operators of the necessity of reducing the very costly waste caused by preventable decay of timber, correspondence indicates a woeful ignorance of the fundamental principles involved.

The article is valuable for its comments on the selection of timber, standard preservatives and their use. Coal-tar creosote oil is the most efficient wood preservative. There is no record of properly creosoted wood. F. A. L.

Mines Magazine, December, 1919.

The Mining Magazine for December contains two articles that are concluded from the November issue. They are "The China Clay Industry of the West of England," and "The Minerals of Anatolia."

The china clay discussion describes the purification of the clay and its preparation for market.

The latter article goes into details of the economic features of the Anatolia district. F. A. L.

MINING.

The A B C of Diamond Drilling. By Bruce B. Ellis. (Arizona Mining Journal, February, 1920.)

In addition to mining prospecting, the diamond drill is coming into use more and more in many other engineering operations, such as testing the underlying rock for tunnels, canals, dams, and bridges. It is necessary, therefore, to know something about the operations of the drill, otherwise its value cannot be fully realized. This article is very good in its description, uses, and costs of diamond drilling operation. F. A. L.

The Combination Method of Mine-Sampling. By Morton Webber. (M. & S. P., February 28, 1920.)

This begins as a summary of the discussion on a previous article on the same subject. "Latent Errors in Mine Sampling" are tabulated under five heads, after a review of the sources of error in hand-sampling. The more important factors of sampling may be seen by noticing the questions asked by other engineers, and their answers. It is shown that secondary enrichment does not vitiate the combination method. W. S. L.

Electric Pull Switch. By Carl Clausen. (Arizona Mining Journal, February, 1920.)

It is a well-known fact that mine signaling methods have undergone several changes to make them as "fool proof" as possible. Not only do all mines use some system of signaling, but there are many factories, railroads and others who use some kind of a system of signaling.

This article describes the electric signal system in detail and compares it to other methods. The requirements necessary for the electric system are also described. F. A. L.

Loading Machines for Underground Use. By A. M. Gow. (E. & M. J., January 31, 1920.)

This is a general review of the labor-saving devices which have been produced in an effort to reduce the cost of shoveling underground. The opportunity open to inventors is emphasized by the fact that no machine has yet been made adaptable to varying conditions. The advantages of artificial loading, over-working, in saving men, time and material are clearly explained. The article is well illustrated by pictures and diagrams of different types of machines. W. S. L.

Applying the Blueprint Round. By Charles H. Waters. (E. & M. J., February 7, 1920.)

By following the directions, the use of the blue print may be made of practical value in drilling operations. Very little practice is required to make the miner familiar with the computation of scales and angles and with the utilization of tables. The gist of the article is in a reference table showing the depth of the hole, and the distance its bottom will be shifted by a change in the drilling angle. The article ends with a well-justified plea for standardized drill parts and connections.
W. S. L.

Jackhammer Type Drills in Witwatersrand Mines. By E. M. Weston. (E. & M. J., February 7, 1920.)

In Africa it is found that shortage of labor makes jackhammers and small piston drills necessary, although there was a time when hand drilling was cheaper. The former impediment to power drills in drilling overhead or horizontal holes—that is, the difficulty in preserving the alignment of the hole, has been removed by the construction of a drill rig weighing only fifty-eight pounds. W. S. L.

The Use of Ferro-Concrete in Mines. By T. J. Gueritte. (Colliery Guardian, December 26, 1919.)

Ferro-concrete is one of the most ubiquitous of materials. Its advocates have brought it forward in connection with nearly every form of immobile structure. It has been used for bridges, floors, culverts and sewers.

This paper deals with its use in underground workings where the confined working space and the impossibility of handling large members often gives reinforced concrete a very material advantage over structural steel. For stoping, which may be subjected to pressure arising from explosion or a blow-out shot, reinforced concrete is again suitable.

The material is easily handled to almost any desired working place, and when once set is as good as any material for strength that could be obtained.
F. A. L.

Rotary Rock-Drill Bits. By A. G. Wolf. (E. & M. J., February 7, 1920.)

The application of rotary methods to oil well drilling has resulted in the invention of several types of rock bits, each one embodying individual characteristics. The Hughes Reaming Cone Bit consists of a steel body in two halves. At the lower end are two cones of hard steel, with ridges radiating from the apex.

Cylinders similar to these are set in the sides to ream the hole. This is an example of the hard rock bits. The others operating on similar principles, but achieving the same result by variations in the shape and position of the rollers.
W. S. L.

Mining in the Asiatic Near East. By Leon Dominion. (E. & M. J., January 31, 1920.)

The economic importance of mineral lands in the Caucasian section of the former Russian Empire and Persia is explained. The history of early mining operations and the possibilities offered in that region for new mining enterprises are described. The region contains many of the world's oldest mines, some of which have been worked for over eight hundred years. The list of minerals includes copper, manganese, emery, chrome, antimony and mercury. Lignite is found in Asia Minor, Armenia, and Syria, and the frontier between Turkey and Persia contains a rich oil field. In the past, surface mining has been practiced, so that the deeper veins are now practically unexplored.
W. S. L.

Mining at Cerro de Pasco, Peru. By M. R. Walger. (E. & M. J., January 31, 1920.)

The geology of a famous mining property and the development and mining methods used in its exploitation are described. A classification of the ore reserves is presented, with a description of equipment, statistics of production and a statement of wages and operating costs. The topography and drainage with the problems they have introduced in the operation of the mine are minutely described.
W. S. L.

METALLURGY AND ORE DRESSING.

Some Aspects of Cheap Cyanide Processes. By Herbert Philipp. (Chem. & Met. Journal, February 18, 1920.)

The developments of the cyanide synthesis and the improvements of the ferrocyanide process are reviewed. The reactions between carbon, nitrogen and alkaline bases are explained. The history and uses of cyanogen products are detailed from the time when C_2N_2 was first isolated by Gay Lussac in 1915. It is proposed that the development of future processes will be based on atmospheric nitrogen, and the processes divided into direct synthetic formation and indirect formation.
W. S. L.

The Problems of Reducing Lead Sulphate. By F. N. Flynn. (E. & M. J., February 21, 1920.)

Lead sulphate in acid works and lead smelters originates in the dust and fume from the various operations of roasting, sintering, smelting and converting lead ores. In various smelters it is briquetted, sold to paint makers or stored on the dump. Mr. Flynn has concluded, after years of experience, that low-grade lead sulphates can be reduced most efficiently by electrolysis.
W. S. L.

The Cottrell Process in Japan. By Ritaro Hirota and Kyoshi Shiga. (M. & S. P., February 14, 1920.)

The preliminary experiments in Japan and the part played by the Metallurgical Research Institute are detailed. In some of the Japanese plants the process was installed because of legal injunctions against the dust coming from the plants, but there are now six plants equipped with the process. A list of these is given, including the power and capacity of each.
W. S. L.

Mining and Milling Tin-Tungsten Ore in Tasmania. By Wm. E. Hitchcock and J. R. Pound. (M. & S. P., February 14, 1920.)

This is an illuminating article on the geology of tin-tungsten lodes, mine operations, and details of stoping methods. The mill produces two grades of concentrates at the S. & M. Mine. The "firsts" retain the valuable minerals, but reject pyrite and silica. The "seconds" retain the pyrite and reject silica. Power for operation is obtained from a mill race five and three-quarter miles long, having a fall of sixteen feet to mile, and a bottom width of twenty inches. During two months of the year when water is inobtainable two Robey locomotive-type boilers are used.
W. S. L.

Some Ideas on Ball Mill Practice. By Curtis Lindley, Jr. (M. & S. P., February 14, 1920.)

This deals with an ingenious application of the mathematical law of chance and probability to grinding in ball mills. It explains the effect of dilution and the principal crushing action. The writer's theory is that the work is done not by direct impact of the balls, but by a transference of forces through that portion of the ball mass at rest, by the impact of the falling balls.
W. S. L.

The Bunker Hill Enterprise—VI. By T. A. Rickard. (M. & S. P., March 6, 1920.)

This installment describes the details of the methods of stoping which were formerly used and those which are being used at present at the Bunker Hill Mine. The discussion is enlivened by the aid of excellent diagrams. Unique methods in the smothering of underground fires at the mine are presented. Other items touched on all timbering, skip-ways and ventilation. W. S. L.

Graphite in Quebec, Canada. By H. P. H. Brumell. (E. & M. J., February 28, 1920.)

In this article the author prophesies marked activity in the graphite industry in Quebec during 1920, and attributes this predicted boom to the solution of the problem of separation, which oil flotation seems to have accomplished. In the past high percentage stocks were obtained only by the grinding down of the graphite in the low percentage concentrates being made, but with proper ball mill practice the size of particle will more nearly be maintained, and with oil flotation the resultant finished stock will be larger. The following topics are discussed in order:

1. Geology of deposits compared with similar mineralogical occurrences of Alabama.
2. History of milling processes used in the district.
3. Flotation.
4. Assays and screen tests of products.

W. S. L.

Suggestions for Separating Colloids from Flotation Feed. By Bennett R. Bates. (E. & M. J., February 28, 1920.)

A paper citing an example of the action of colloids in reducing extraction from a silver ore, together with suggestions for the removal of colloids. W. S. L.

Milling Plant of the Alaska-Gasteneau Mining Co. By E. V. Daveler. (Chemical and Metal. Engineering, February 25, 1920.)

A description of a gold milling plant built in the Arctic regions to handle very low-grade ore. A practical process dependent upon the low cost of roll crushing and low values in slimes. An automatic skip hoisting in place of bucket elevators is another unique feature. The article is clear and easily read.

W. S. L.

OIL.

Oil Shales of De Beque, Colorado. By G. Robert De Beque. (E. & M. J., January 31, 1920.)

Mr. DeBeque discusses the development of the oil shale industry and its future possibilities, and describes retorting and refining problems. The properties of the shale are described and possible methods of mining are discussed. The companies engaged in the industry, the location of their holdings, and the approximate cost of production are listed. W. S. L.

Genetic Problems Affecting Search for New Oil Regions. By David White. (A. I. M. E., February, 1920.)

In these days when detailed investigations of the stratigraphy, structure and the geologic conditions so frequently lead to the discovery of new oil fields, it might be of interest to have our attention called to them. The geologic principles controlling the distribution of oil and gas has as yet been discovered only in parts. Those principles that we do know are pointed out by Mr. White, and in search for oil it would be well to apply the principles. F. A. L.

Where the World Gets Its Oil. By George Otto Smith. (The National Geographic Magazine, February, 1920.)

This article is written especially for the National Geographic; it, therefore, needs no comment upon its accuracy. The different oil pools of the world are discussed, showing how important they are in their supply of the world's need.

The great uses to which oil is put and its advantage over coal is also discussed. Mr. Smith hints at the future of oil production. Where we shall get our oil in the future is a question that stands in front of us, and we must meet it. Photographs and maps accompany the article. F. A. L.

JUNIOR METALLURGICAL TRIPS.

The Junior Class took one of their regularly metallurgical and mining trips during the week of March 13-20. Prof. I. H. Palmer had charge of the men. He was assisted by S. Z. Krumm, "Doc." J. C. Roberts, and Prof. L. S. Grant. The trip included the mines and mills of Victor, the mills and coal mines of Colorado Springs, and the steel works at Pueblo. A special Pullman was chartered for the trip.

Electricity is said to be one of the few saleable products which cannot be adulterated.

PERSONALS

'02.

Russel B. Paul is in New York on business.

'06.

W. D. Abel has left Kimberly, Nevada, owing to the suspension of operations of the Consolidated Coppermines Co. His present address is 3897 Sacramento St., San Francisco, Calif.

Newton W. Pilger, formerly of Anchorage, Alaska, is now in business at Fort Worth, Texas.

'07.

Thos. P. Ellis is now resident plant engineer, Emergency Fleet Corporation. Residence address, 369 Pine Street, San Francisco, Calif.

C. A. Filteau is manager of the National Mines Ltd., and Peterson Lake Silver Cobalt Mining Co., Ltd., Cobalt, Ont.

'10.

Robt. M. Keeney has returned to Golden from York, Pa., where he constructed an electric furnace plant for the York Ferro-Alloy Co.

Otis W. Swainson has returned from St. Thomas, Virgin Islands, and is now located in Washington, D. C.

'12.

C. L. Harrington is now with the Radium Co. of Colorado, Inc., at Naturita, Colo.

G. W. Schellenberg has removed from Berkeley, Calif., to West End, Calif., via Searles.

W. G. Ramlow has moved from 1377 Selby Avenue to 1045 Pleasant Avenue, St. Paul, Minn.

'13.

I. A. Chapman is in the Engineering Department of Jardine, Matheson & Co., Ltd., 25 Madison Ave., New York.

Walter E. Heinrichs resigned his position at Superior, Ariz., to become assistant superintendent of the Wellington Mines Co. at Breckenridge, Colo.

Frank Downes and Miss Katherine Livingstone, of Golden, Colo., were married on Saturday, February 14th, at Denver.

'14.

Melvin Brugger has resigned as engineer for the Minas de Matahambre, Pinar del Rio, Cuba, to go to Angola, West Africa, where he has a splendid offer.

'16.

Raymond V. Whetsel has gone to Tampico, Mexico, for the National Petroleum Co.

Wayne A. Harrod has accepted a position as assistant manager with the Babcock Mining Co. at Gold Hill, Utah.

Roy H. Miller is assistant superintendent, Furnace Refinery, Great Falls, Mont.

'17.

Sidney S. Small left Hibbing, Minn., where he was with the Arthur Mining Co. He is leaving on a trip to New York and thence will visit the Western and Southern Oil Fields for some clients. Mail addressed to Lynn Haven, Florida, will reach him.

Norman E. Maxwell has left the Burro Mountain Copper Co. at Tyrone, N. Mex., and is at present in Golden.

'19.

O. H. Metzger, engineer at the Minas de Matahambre, Cuba, had a narrow escape from being killed when the hoistman lost control of the cage. It fell from the 8th to the 9th level, a distance of a hundred feet, and struck the chairs on the ninth level. The cage and the mine car, which was on the cage at the time of the accident, were both demolished, and how Metzger escaped with his life is a mystery. Metzger is confined to his bed with a badly wrenched back and several severe bruises. He is expected to be around in a short time.

'20.

Fitch Robertson is located at Metcalf, Arizona.

EX-MINES NOTES.

'08.

T. C. Linderfelt is geologist for the Rood Oil Corporation, Bartlesville, Okla.

'15.

Clarence T. Todd has accepted a position in the Engineering Department of the Ray Consolidated Copper Co., Ray, Ariz.

'17.

C. C. Taylor has left the Arthur Mining Co., Hibbing, Minn., and is now engineer with the Cleveland Cliffs Iron Co., Ishpeming, Mich.

MISCELLANEOUS.

F. R. Field, manager of the Denver office for The Jeffrey Mfg. Co., has been transferred to Los Angeles, Calif., to take charge of the company's newly opened office. This office will attend to business in California, Arizona, Nevada and Sonora, Mexico.

Miss Frieda Watkins, for several years secretary to T. C. Doolittle, Registrar of the School, has resigned to accept a position with the Western States Oil & Gas Co. of Casper, Wyo. Mrs. Mary McAtee has been appointed to the position.

School News

Dr. Victor C. Alderson has been reappointed to the presidency of the Colorado School of Mines for a period of two years.

Dr. John A. Barrett, director of the Pan-American Union, Washington, D. C., will deliver this year's Commencement Address on May 10th. This is much earlier than is customary, but in order to have the honorable speaker preside, this was necessary. The examinations will be held the week after the Commencement exercises.

The following resolution was passed by unanimous vote of the Board of Trustees of the Colorado School of Mines on Thursday, March 10, 1920:

"Resolved, That loyalty to the institution, to its ideals, and to those connected with it, will be considered of the utmost importance, and that, even though ability and attention to duties are marked, any member of the faculty, or other employee, who attempts to undermine the school, or to advance personal interests at the expense of his colleagues or the School, will not be retained.

Three types of retorts for the distillation of oil shale are being installed at the Experimental Plant by private parties. They are the Wallace, Stalman and Ginet.

The Theta Tau Fraternity held their second annual dance at Guggenheim Hall on Friday evening, February 28th. There was a large attendance. The various fraternities all held elaborate house parties.

SCHOOL SHOWS GROWTH.*

By Harl D. West.

The new catalog edition of the Colorado School of Mines Quarterly is just off the press, and contains a wealth of information regarding the institution. One of the interesting features of the catalog is a page showing the geographical distribution of the homes of the students. Colorado is, of course, in the lead, with 180 registered. Texas is the next one of the United States, with 16, while California and New York come next with 15 each. Pennsylvania has 10, while Montana, Oklahoma and Washington have 8 each. From each of Indiana, Kansas and Nebraska 7 are registered. There are one or two registered from nearly every other state in the union.

In the table showing registrations from foreign countries, China has the lead, with 13. Mexico is next with 7. Chili has 5, and Bolivia and Philippine Islands have 3 each. There are 1 each from Brazil, Korea, Germany, Japan, England, Java, British Columbia and the Hawaiian Islands.

Out of all the foreign students registered in all the colleges of Colorado, more than half of them are registered at the School of Mines. In all the colleges there are 61 students on the rolls from foreign countries, and 37 of them are at the School of Mines.

Another interesting feature in connection with the enrollment at the Mines is the number of graduates of other colleges who are taking post graduate courses here. Among the colleges represented are the following: New Hampshire State College, Princeton University, Alabama Polytechnical Institute, Oregon Agricultural College, Citadel College of South Carolina, Miami University, University of Alabama, Virginia Military Institute, Louisiana State University, Cornell University, George Washington University, and Roanoke College.

The Colorado School of Mines has the largest membership in the American Institute of Mining Engineers of any institution in the world. Officers of the Mines chapter are Myron L. Sisson, president; Louis C. Fopeano, vice-president; Ronald K. DeFord, secretary and treasurer.

Other features in the new catalog are the departments devoted to outlining the course in military training, standard text and reference books, the courses in English and finance. The class in finance is proving of especial interest, for it is a well-known fact that engineers frequently fail to appreciate the financial aspect of their work. To obviate the defect, President Alderson offers this course in the form of a seminar. Attention is called to the great world movements that cause variations in the market value of securities, the minor market movements, and the general trend of the prices of commodities. Members of the class follow closely the market value of a group of selected securities on the New York Stock Exchange. At each meeting one member analyzes a security and endeavors to decide whether the quoted price is above, below, or at its real value. The Wall Street Journal, the Magazine of Wall Street, John Moody's Investment Service, besides many works on finance, are available in the library. A strong effort is made to get the student interested in financial matters, to induce him to read financial literature, and to form his own opinion of the results of the forces at work to determine the market value of securities.

* From Colorado Transcript.

ATHLETICS

By F. A. Lichtenfeld, '20.

CONFERENCE STANDING.

	Won	Lost	Pct.
U. of C.	3	1	.750
Mines	3	2	.600
Aggies	3	2	.600
Colorado College	2	2	.500
D. U.	1	3	.250

BASKETBALL.

Mines, 28; Wyoming, 19.

The University of Wyoming basketball quintette met their first defeat in the hands of the Mines, in Golden, by the score of 28 to 19. Wyoming's defeat, however, should not lead one to infer that they have a weak team. Quite to the contrary; they have an exceptionally strong one, but the unusual accuracy of Mines in shooting baskets was the factor responsible for their defeat. In all other departments of the game they excelled in cleverness. Their passing and team work were excellent. Time after time the Cowboys carried the ball with a rush toward their basket, only to lose the ball after a poor shot at the loop, or to lose it by close guarding.

Despite their clever passing and headwork the first half ended with the score of 17 to 4 in favor of the Mines. Wyoming was never able to overcome this lead, the score in the second half being 15 to 11 in the Mines' favor.

Neff, Simson and Burnes starred for Wyoming. Toward the last few minutes of play Coach Corbett sent his second string men into the game. Dunn and Davis were the stars for Mines. Dunn scored five field goals the first half of the game. Davis guarded the Cowboys in an unusual manner. The score follows:

MINES—	F.G.	F.T.	P.F.	T.F.
Dunn, f.	5	0	1	2
Bryant, f.	3	4	0	0
A. Bunte, c.	2	0	3	0
Rhodes, g.	1	0	1	1
Davis, g.	1	0	1	0
Gallucci, g.	0	0	0	0
Totals	12	4	0	3

WYOMING—	F.G.	F.T.	P.F.	T.F.
Layman, f.	0	1	0	1
Simson, f.	3	0	0	1
Burns, c.	1	3	0	5
Neff, g.	0	0	0	0
Clime, g.	1	0	2	1
Thomson, g.	1	0	0	0
Hegewald, f.	0	1	0	0
Gregg, c.	1	0	0	0
Knight, g.	0	0	0	0
Totals	7	5	2	8

Mines, 33; D. U., 11.

The Mines basketball team defeated the Ministers at Golden by the score of 33 to 11. D. U. was completely outclassed, and at the end of the first half Mines had them in their clutches by the score of 20 to 6, two points of which were made from free throws from fouls. Denver didn't make five field goals during the contest.

Bryant for the Mines made five free throws out of a possible six, and Rhoades made one, the only one tried. D. U. made three out of eleven.

Ernest Bunte suffered a sprained ankle early in the game and was compelled to retire, Rhoades taking his place. Toward the end of the game a number of Mines second string men were given a chance to play. A. Bunte and Rhoades were the individual stars for Mines. Finesilver and Chase did good work for D. U. The guarding of Finesilver was good and it prevented the Mines from doubling their score.

The refereeing of the game by Hackenson was another marked feature.

MINES—	T.G.	F.T.	P.F.	T.F.
Dunn, f.	1	0	0	1
Bryant, f.	2	6	2	1
A. Bunte, c.	5	0	0	0
E. Bunte, g.	0	0	0	0
Davis, g.	1	0	1	0
Swift, f.	0	0	1	0
McCartney, c.	0	0	0	3
Rhodes, g.	4	1	2	0
Totals	13	7	6	5

D. U.—	F.G.	F.T.	P.F.	T.F.
Robb, f.	1	0	1	1
Cutter, f.	1	0	0	0
Phillips, c.	0	2	0	0
Finesilver, g.	0	0	1	0
Iliff, g.	0	0	3	0
Graham, c.	1	0	0	0
Chase, f.	1	1	1	0
Recht, f.	0	0	0	0
Galligan, f.	0	0	1	0
Totals	4	3	7	1

Mines, 16; Aggies, 20.

Aggies seemed to have upset the dope in basketball when it defeated the School of Mines in the first game played between the two schools. The game was hard fought; the Mines excelling in team work, but losing in shooting baskets. It seems as though the ball couldn't go through the loop.

Bresnahan and Kirstoff did excellent work for the Aggies. They had their eye on the loop. Each made four field goals.

Art Bunte, Dunn, and Bryant, did the best work for Mines. Bunte has six field goals to his credit. He was the only Mines who still had his batting eye.

Mines, 24; Colorado College, 17.

The Colorado School of Mines defeated Colorado College by a score of 24 to 17. The game was fast and probably the most interesting basketball game witnessed in Golden for many a day.

The victory for the Mines was a decisive one. Coach Parsons of the Tigers evidently likes to coach grandstand playing. His squad of men took great delight in shooting from the middle of the floor. It was one of these long shots that started the game off with a zip. C. C. scored first by making two free throws, but the Mines started off with a rush soon after the ball was tossed up, a third time, and scored a full goal. They took the lead in the next few seconds of play and were never in danger during the remainder of the game. The first half ended with the score 11 to 5 in favor of Mines.

The second half was as interesting as the first, C. C. gaining 12 points and Mines 13. The Tigers tried hard to overcome the lead that was forced upon them, but the Mines were too clever for the huskies from the Springs.

Les MacTavish did the best work for the Tigers. He played a steady game and was their chief point-maker. Honnen succeeded in tipping the ball off to one of his men most every time it was thrown up at center. He was guarded closely, however, and only two field goals were registered by him. The C. C. men had good team work, but were weak on shooting goals.

The score is as follows:

COLORADO C—	F.G.	F.T.	P.F.	T.F.
L. MacTavish, f.	1	7	2	1
Yates, f.	0	0	0	0
Honnen, c.	2	0	1	0
Hughes, g.	1	0	0	0
E. MacTavish, g.	0	0	1	1
Lloyd, f.	1	0	1	0
Total	5	7	5	2

MINES—	F.G.	F.T.	P.F.	T.F.
Dunn, f.	2	0	0	2
Bryant, f.	1	4	1	0
A. Bunte, c.	5	0	1	0
Davis, g.	1	0	1	2
E. Bunte, g.	1	0	2	1
Total	10	4	5	5

Boulder, 27; Mines, 19.

The University of Colorado defeated the fast Mines quintette 27 to 19 at Boulder. This victory over Mines places Boulder in the lead for conference basketball honors. The game was hard-fought throughout and was brilliant at times, but marred by poor passing and loose team work. The State played air-tight ball on defense, and coupled with several flashes of offensive rallies, gave them the better of the argument. The Mines could only make five field goals from the crack U. of C. guards. Most of these were lucky long shots. The Ore Diggers were wild throughout the contest and couldn't gauge their shoots, but after a poor start they managed to finish the first half by a score of 15 to 7 in favor of Boulder.

At the beginning of the second half Mines displayed a brilliant flash of team work and ran the score to 14 to 16, only two points behind their leaders. They could not keep up their pace, however, and were forced to play on defense to prevent the States' onslaught.

Lee Willard was the star for Boulder. Williams, who played in place of Bell at forward, was also responsible for Boulder's score.

Schrepferman was disqualified in the second half on personal fouls. Bidal relieved him.

Bryant for the Mines scored 15 points, 9 of these, though, were on fouls and six field goals. Dunn and A. Bunte made the other points for Mines.

Both Willard and Rhodes, Mines guard, were injured, but continued to play. Rhodes had a dislocated shoulder and this greatly hampered his playing, but despite this handicap he played a good game at guard.

The score:

COLORADO U.—	F.G.	F.T.	P.F.	T.G.
Willard, f.	4	7	1	1
Williams, f.	3	0	0	1
Breckenridge, c.	2	0	1	4
Schrepferman, g.	0	0	4	1
Brown, g.	0	0	1	0
Bidal, g.	1	0	0	0
Total	10	7	7	7

MINES—	F.G.	F.T.	P.F.	T.G.
Dunn, f.	0	0	0	1
Bryant, f.	3	9	1	1
Bunte, c.	1	0	2	2
Davis, g.	0	0	2	0
Rhodes, g.	0	0	2	0
Total	5	9	7	4

Free throws missed: By Willard, 4; by Bryant, 6.

Referee: Search, of Greeley.

Mines, 13; Colorado College, 20.

Colorado College defeated the School of Mines in basketball at Colorado Springs 20 to 13. The game was roughly played with both teams guarding closely.

The Tigers opened up the scoring with a pretty basket by Lloyd. Bryant of Mines followed with a fine throw. C. C. had the jump on Mines which they held throughout the game. Twelve minutes elapsed before another point was scored by either team. Rough and tumble basketball resulted, during which the Tigers had possession of the ball most of the time. Mines rallied toward the close of the first half on baskets by Bryant and Dunn with a result that the Tigers only led by an 8 to 6 score at the close of this half.

The second half saw the Tigers sweeping the floor, and soon ran the score to 14 to 7. The Mines then pressed the College hard, and the game ended, C. C. winning by 7 points. The low score can give some indication of close guarding.

A. Bunte was the individual star for the Mines, but the work of Dunn and Bryant was also very good. Bryant gathered seven free throws and in all scored 9 of the 13 points.

MacTavish's defensive play and the field goals of Birdsall and Lloyd gave C. C. their victory. The score:

C.C.—	F.G.	F.T.	P.F.	T.F.
Lloyd, f.	4	2	4	1
Newbold, f.	0	0	1	0
Birdsall, c.	3	0	0	0
E. McTavish, g.	0	0	0	1
Hughes, g.	0	0	0	1
Yates, f.	1	2	2	0
L. McTavish	0	0	0	0
Totals	8	4	7	3

MINES—	F.G.	F.T.	P.F.	T.F.
Dunn, f.	1	0	1	0
Bryant, f.	1	7	1	1
A. Bunte, c.	1	0	4	0
Dairs, g.	0	0	2	1
Rhodes, g.	0	0	0	0
E. Bunte, g.	0	0	0	0
Robertson, c.	0	0	1	0
Gallucci, g.	0	0	0	0
Totals	3	7	9	2

Referee—Jones of Indiana.

BOXING AND WRESTLING.

D. U. Beats Mines Mat Men.

Denver University wrestling team defeated the School of Mines mat men in four out of a possible seven matches. One bout was won by D. U. by default. W. K. Crawford of Mines failed to make the weight at the agreed time. The results of the bouts were as follows:

125-pound class: Baur of D. U. defeated Kay of Mines at the end of 15 minutes of wrestling; 135-poung class: Steely of D. U. put a body scissors on Jones of Mines and won in 6:23 with a head lock and his scissor. In the 115-pound class Miller of Denver defeated Min of Mines in 8:14 with a full body scissors and a head hold. Serafini won the decision on aggressiveness, although Gills' was good, and the bout was the most interesting of the evening. In the 158-pound class Parker of Mines threw Richards of D. U. In the final bout Crawford threw Hopfu of D. U. in 2:19, using a half-nelson and body hold.

As a whole, the tourney was a grand success and was witnessed by a large enthusiastic crowd.

Aggies-Mines Wrestling and Boxing Meet.

Honors were about even in the wrestling and boxing tournament between the Mines and the Fort Collins crew. The Mines had the better of the boxing, but Aggies scored heavily in wrestling.

Boxing has a tendency to become a matter of slaughter rather than boxing among the colleges. The art of self-defense is rarely displayed. Although the branch of sport is young yet such strates will kill boxing in colleges. High-class instructors should be hired to coach the men at boxing and they should not teach their men that it is not always the blow that counts ten and signifies the best man.

The results were as follows:

Wrestling—115-pound class, Wahlgren of Aggies beat Ed. Min of Mines; 125-lb., Snodgrass of Aggies defeated Kay of Mines; 135-pound, George Anderson of Aggies defeated Jackson of Mines; 158-pound, Frank Tolliver of Aggies threw R. F. Crawford of Mines in 9⅛ minutes; 145-pound, Ted Serafini of Mines won over Woolam, of Aggies; heavyweight, Frank Tolliver of Aggies defeated G. W. Crawford of Mines.

Boxing—115-pound class, Levings of Mines, defeated Wahlgren of Aggies; 125-pound, Aramson of Mines, defeated Malcomb, of Aggies; 125-pound, Stroke of Mines, defeated Ammon of Aggies; 145-pound, Mathieson of Aggies defeated Watson of Mines; 158-pound, Hines of Aggies, knocked out Clothier of Mines in the second round; heavy-weight, La Doone, of Aggies defeated Crouse of Mines.

CHUCK SCHNEIDER TO LEAD MINES IN BASEBALL.

Chuck Schneider was elected captain of Mines baseball team. Schneider is an all-round athlete and it is regarded as certain he will lead the team to a championship this year.

A call for baseball men has been issued. A healthy bunch of fellows responded to the call, and Coach Glaze will get busy helping the southpaws getting their arms in shape.

(Continued from page 48.)

LEASING FIGHT ENDED.

original land policy of the United States, which extended the right of patent for oil and mineral lands, but which right has been largely mythological and ineffective since presidential withdrawals began some years ago, and since the Interior Department adopted the policy through which continuous additions were made to these withdrawals, even in developed, or developing areas after the making of secret investigations and filing of secret reports.

About forty-six million acres of supposed coal lands in the West, about six million acres of supposed oil lands, and about three millions of acres of supposed phosphate lands, together with hundreds of thousands of acres of sodium, all of which are scattered through several States, are finally opened up to public development under a permanent leasing system.

The fight has been a long and expensive one. The rights of the West, and particularly State rights, have been jeopardized by the enthusiastic "Federal control" school which seemed to take lead in proclaiming Federal over State rights; and during the past two years, the fight, which has sometimes been a very biter one, has been largely confined to an attempt to secure justice for those who, prior to withdrawals, had either filed upon or developed properties in the areas withdrawn. There has never been a measure more biterly fought out along technical lines with apparent determination on the part of the Administration to give no quarter and to allow no liberality in phrasing, and the Bill as now completed—while a complete defeat for States rights advocates, practically results in confiscation of many properties which have been continually added to by process of absorption and coalition between corporations beyond the extent of the 3,200 acres allowed as a leasing limit. It is said that one estate alone will lose more than two millions of dollars by the aplication of the technical clauses allowing confiscation beyond the limited acreage. Those having filed claims, purchased rights or in any way acquired claims upon withdrawn lands previous to the dates involved, will be allowed first privilege in the matter of leasing on licenses.

No More Withdrawals.

The passage of the Bill will end the policy of withdrawals established under the Taft administration, and will permit development under a leasing system whereby the Government and State automatically become interested in the development of coal, oil, shale, and phosphate lands in the West. If the land is good. the prospector can prosecute his claim for patent, provided he has established his right previous to the withdrawal, and if the land is not good he is permitted under the Leasing Act to abandon his claim by relinquishment without prejudice to other holdings.

One immediate and direct effect anticipated is that many of the favorably located structures in Western States that have been withdrawn in recent years will now be opened for exploration, development, and lease. The fight against the patenting system has been very detrimental and costly to the entire industrial development of the West.

Another immediately favorable effect will be the releasing of six to ten millions of dollars to the School and Road Funds of the States interested, and one of the best features of the bill was finally agreed upon is that except for the 10 percent which is to be paid directly into the Treasury of the United States all of the leasing and royalty money is to be spent in the West for such improvements as reclamation, schools, roads, etc.

Alaskan Oil.

The Alaskan clause in the Oil Leasing Bill will, it is believed, open a vast area of oil lands in Alaska. It is said by representatives of various corporations now in Washington that the Alaskan conditions are favorable and that they will quickly result in large development in that territory.

VOL. X APRIL, 1920 No. 4

COLORADO SCHOOL OF MINES MAGAZINE

THE COLORADO SCHOOL OF MINES ALUMNI ASSOCIATION, PUBLISHERS, GOLDEN, COLO.

Method of Mining Coal Without Powder

By D. Vance Sickman, B.S., E.E.

Part I.

This method consists of a combination of appliances which provides a simple, easily operated and purely mechanical means for breaking down coal after it has been "undercut" in the usual manner. Every detail has been carefully worked out. The method of application and the design of the appliances used, conform with established engineering principles. After the coal has been undermined, the mechanical process of breaking it down, ready for loading out, consists of the use of two mechanical elements (a) The Slotting Machine, and (b) The Hydraulic Expanding Bar. The functions and operating characteristics of each of the machines are as follows:

(a) The Slotting Machine.

This machine represents the final achievement in the successful development of this process of mining. Its purpose is to cut rectangular slots in the coal for the insertion of the Hydraulic bar. The important operating features of the machine are:

(1) Transportation.

In the introduction of any new or additional mining appliance, the extent to which it may interefere with or interrupt the ordinary mining processes in use, is of great importance to the operator. The transportation of coal and the necessary coal mining machines etc., must not be interferred with. In most mines the transportation facilities are already burdened and the introduction of any additional appliances, that would have to be transported from place to place over the same haulage ways, would result in loss of output, and further complicate underground operations in general. To overcome this difficulty the slotting machine is mounted on a self-propelling bed plate of the "chain-track," or "caterpillar," tractor type and driven from place to place in the mine in the same manner as the ordinary tractor is driven on the farm. This construction entirely eliminates any interference with transportation over the trackage system. It is propelled by electric motors, or rotary air engines, using the same power as the other mining machines in use. In practice this machine is driven from room to room through the "cross cuts," thus saving traveling distance, as the "cross-cuts," by law, cannot be more than 60 feet back from the "face", or an average of 30 feet, in order to pass from one room into the next adjacent room. The machine can travel to almost any part of the mine by keeping open the last "cross-cut". The "chain track" of the bed plate is also provided with flanges to fit the gauge of track in use and the machine can be run upon the rails and driven to any part of the mine, should this be desirable.

The total weight of the slotting machine is approximately 6,000 pounds, and as the length of the "caterpillar track", or what would be the "wheel base", is approximately 5½ feet, the machine can be run on twelve pound rails.

The construction of a self-propelled, self-contained slotting machine, transported from room to room on its own bed plate, insures this part of the process being carried out with great rapidity, without interferring with any other equipment, or being itself delayed, and permits of the introduction of this process of mining without causing the slightest interference with any other operation.

(2) Manipulation.

The over-all width of the slotting machine is approximately 3 ft. 10 in., and length over-all 8 feet 4 inches. These dimensions vary somewhat, depending on the height of the vein in which the machine is used and the depth of the undercut. Each side of the "chain-track" can be operated independently, and also reversed independently. By this construction the machine can be manipulated to make a right angle turn, or turned end for end, that is, completely around, in a space not exceeding its own length. The size of the bed plate is such that it can pass between "props" set 4 feet apart. The speed at which one "chain-track" is driven, relative to the other, can be varied at will and the machine will travel a course of any degree of curvature. The ease with which the machine can be manipulated enables it to travel from room to room, avoiding props or other obstructions and also to be quickly adjusted in position for cutting the slot in the face of the coal, where required. Also the machine will travel up a 10 to 15 per cent grade, through mud and water, and over rough, rocky or soft bottom, with the greatest ease. The speed of travel can be varied from barely moving up to two hundred fifty feet per minute.

(3) The Cutter Bar.

Mounted above the traveling bed plate is the cutter bar, used for cutting the slot. This cutter bar, with its driving and feeding mechanism, is practically the old style low vein "breast machine", used for under-cutting coal for many years. Conceive this type of breast machine turned upside down, and that part of the supporting frame removed that will permit of the bar being raised so as to cut a slot close up against the roof (instead of underneath), the motor and driving mechanism remaining the same, except that it will now be on the under side of the machine. This practically. is what is done, the frame simply being changed where required, the entire driving and operating mechanism remaining the same as in the standard machine. Various unnecessary parts and fittings have been omitted or changed, and also the width of the cutter bar reduced, this bar being the latest "short wall" type, and furnished for cutting slots of various dimensions, 18 in., 24 in., and 30 in. long, by 4¾ in. wide and up to 7 ft. in depth. This cutter bar and driving mechanism is supported so as to be raised and lowered **bodily** by means of hydraulic jacks, or rams. This is easily and quickly done, simply by opening and closing the valves controlling the water supply to the lifting ram. A small high pressure, motor driven, turbine-type pump is used for furnishing the water to operate the rams, and as the bar is lowered, the water is pumped back into a small, five gallon tank and used over and over again. In the collapsed position, the cutter bar, with its driving mechanism, drops into sockets, formed in the bed plate frame, and is held perfectly rigid for transportation about the mine. Also, the bed plate itself is provided with three lifting rams, two mounted at the back end and one in the center of the front end. By means of these three rams, the **bed plate itself** can be raised and lowered and the cutter bar given any angle of adjustment. The position of the bar is therefore subject to the combined adjustment of the bed plate rams in conjunction with the rams which raise and lower the cutter bar itself. This combination results in the following:

(A) Very Wide Total Adjustment.

That is, wide range of height of vein in which a slotting machine of a given design can be used. For instance, in a slotting machine designed for a 6 foot vein, at the lowest or collapsed position of the cutter bar, the over-all height is 3 ft. 6 in., giving a normal clearance or head room, of 2 ft. 6 in. By adjusting the rams which raise the bed plate carrying the entire machine, an adjustment in excess of two feet is obtained. After this adjustment is made, the rams that raise the cutter bar from the bed plate can be operated to raise the cutter bar itself an additional 26 inches, making the total adjustment of the cutter bar 4 ft. 2 in. This size machine therefore can be used in coal varying in height from 4 ft. to 7 ft. 8 in, and for cutting slots halfway up in the vein, approximately, if required.

(B) Angular Adjustment.

By manipulation of the three rams for raising the bed plate, this bed plate, carrying the cutter bar, can be adjusted so that the cutter bar will assume any angle relative to the roof. In veins of 7 feet or less in thickness, three slots only are cut as close to the roof as possible, and parallel to the roof. Unless the roof is very uneven, the cutter bar will lie right against the roof. Often the roof changes pitch relative to the bottom, and to adjust the position of the bar under these conditions, the bed plate is given the proper angular adjustment. Also in veins over 7 feet in thickness it is sometimes necessary to put in a "bust shot". This is done by cutting a slot halfway up the vein in the center of the room, and slightly angling downward. This adjustment is readily obtained. The coal broken down by the "bust" shot is first removed by a special appliance (not herein described, but which does this quickly and easily), before the remaining coal is brought down. This provides a large space into which the remaining coal falls so that it can be readily loaded out. In veins less than 7 feet this is not required.

(4) Locking Device.

When the slotting machine is in position and the cutter bar adjusted ready for cutting the slot, the machine is locked in position. This is done by two additional hydraulic rams which press against the roof. The ends of these rams are provided with large, round, spiked, swiveling bearing shoes. The force exerted against the roof is couter-balancer by the force against the bottom, taken up by the two rams mounted on the back end of the bed plate, which are used for raising and adjusting same. The rams bear against the roof with a force of two tons each, the pressure being constant and furnished by the same small turbine pump used for operating all the rams. When these rams are forced against the roof the whole machine is locked in position. and rigidly held immovable while the cutter bar is in operation.

(5) Operation, Maintenance and Labor Required.

The slotting machine is operated by one man. The machine is easily and quickly driven from place to place in the mine, in self-contained, quickly adjusted in position and about the hardest work the operator does is to open and close the valves used in the above adjustment. The self-propelling bed plate is a fully developed machine of the tractor type which has been in use for many years. The hydraulic ram adjustment of the cutter bar is standard practice, used in many other machines, and is simple in operation, requiring practically no maintenance or operating cost. The cutter bar and driving mechanism are standard, having been in use for over twenty-four years. This slotting machine is, therefore, simply the combination of two fully developed machines and will require no more than normal maintenance cost, and on account of the ease and rapidity of operation, the labor cost is less than any other machine in common use in coal mining. In operation, the cutter bar is simply inserted the proper depth, from five or six feet, depending on the depth of the undermining, and then withdrawn. The forward cutting speed is from 24 to 30 inches per minute, and the pull back speed, 12 feet per minute. This cuts the slot ready to insert the hydraulic expanding bar. The standard width of the slot is 4¾ inches, and the length is varied for using the small, medium or large size hydraulic bars by simply using cutter bars on the slotting machine of the proper width, either 18 inches, 24 inches, or 30 inches, as required.

(B) THE HYDRAULIC BAR.

The hydraulic bar used in this process represents the result of over fourteen years of experimenting and designing. The smallest size bar, No. 1, has a total expanding capacity, at normal water pressure of one million pounds (500 tons); No. 2 bar, one million five hundred thousand pounds (750 tons); No. 3 bar, two million pounds (1,000 tons), and No. 4 bar (the largest size), two million five hundred thousand pounds (1,250 tons). The smallest size bar, No. 1, is made in one piece and is "L" shaped. For this size bar the slot is cut 18 inches long. The short side of the bar is 17 inches long and contains three very powerful pistons, while the long side is 27 inches long and contains five pistons. At normal water pressure, this bar develops a total expanding force of nine hundred and seventy-five thousand pounds. This size bar is suitable for coal 4 feet to 5½ feet in thickness. In all other sizes, the bar is made up of two members, or sections, in effect two separate bars. The shorter section is inserted so that the pistons lie parallel to the back wall of support, and the longer section is inserted parallel to the "rib" wall. When both bars are properly placed in the slot, the forces are applied in planes at right angles to each other, one to shear the coal off along the "rib" wall, and the other along the back wall of support. Making the larger size bars in two sections, facilitates placing the bar in the slot, as each section is comparatively light in weight and much easier to handle. In the largest size bar, No. 4, the shorter member, which is placed in the slot first, and parallel to the back wall, contains six very powerful pistons and weighs 159 pounds. The longer section, placed parallel to the "rib" wall, contains seven pistons and weighs 192 lbs. It has been demonstrated that bars up to 200 pounds in weight can be easily handled by two men and often by one man alone, so that the above weights are well within practical limits. The slot for the No. 4 size bar is cut thirty inches long. This bar at normal water pressure has the enormous exertive expanding force of two million four hundred thousand six hundred (2,400,000) pounds. From a large number of experiments, it has been demonstrated that a force of one million (1,000,000) pounds, in a bar thirty inches long, will shear lignite or bituminous coal 7 to 8 feet in thickness, when the bar is placed 12 inches distant from the termination of the undermining at the "rib," and parallel to the "rib" wall, the coal being undercut six feet. Lignite coal is much tougher, tenacious and harder to shear than the higher grades of bituminous coal. In the No. 4 size bar, the section that parallels the "rib" wall develops one million three hundred and nine thousand six hundred pounds (1,309,600) pounds at normal water pressure, which is fully one-third greater than the force required to shear lignite or bituminous coal of any character nine feet or more in thickness, and undercut 6 to 7½ feet. The bars can be varied in design and capacity to fit any particular condition, or character of coal in which they are to be used. The size of the pistons and the number of pistons used can be varied at will so that the exertive capacity can be increased to meet almost any requirement. Normally, however, the pistons in the section of the bar that is placed parallel to the back wall of support, although fewer in number, are larger in size and exertive force than those in the bar placed parallel to the "rib" wall, the total expanding forces being about equally divided between the two sections. All types of bars are rectangular in cross section, and 4½ inches in depth, which permits of their being readily slipped into the slot which is 4¾ inches wide. The width of the bar varies in accordance with the size of pistons used, water pressure, etc. The smallest bar is 4¼ inches wide and the largest size is 5½ inches wide. The one and a half million pound bar, No. 2 size, is five inches wide. This size bar is suitable for coal 6 to 8 feet in thickness. The shorter section weighs 112 pounds and the longer section 168 pounds. All parts of the bars are made of chrome vanadium heat treated steel, drop forged into proper shape and machined to dimensions. This steel has a minimum ultimate tensile strength of 200,000 pounds, and a minimum elastic limit of 180,000 pounds per square inch.

(2) Piston Construction.

The enormous forces developed by the hydraulic bar, ranging from 1,000,000 to 2,500,000 pounds exertive force, necessitates special construction of the pistons and piston chambers. Many peculiar internal reactions, bending moments, and stresses, are developed, and to relieve the bar of these and prevent distortion, they must be eliminated. To do this the pistons are of the "reaction type," one piston being ejected downward, or against the coal to be broken down, and the other upward, or against the solid roof rock. In construction the pistons are telescopic, and the forces exerted are counter-balanced within 18 percent, thus relieving the piston chambers, as well as the bar containing same, or such internal bending moments, stresses and reactions, as would otherwise cause distortion and make the bar imperative. In effect, the bar acts simply as the container, holding the pistons and piston chambers in position, the internal stresses tending to bend the bar itself being reduced to 18 percent of the maximum expanding force exerted by any one piston. The bar is sufficiently rigid to withstand easily this force. Engineers who have examined this type of telescoping piston pronounce it a most ingenious design, yet it is simple in construction, easy to manufacture and extremely powerful. It represents the result of years of constant experimenting and designing. One of the most important and necessary operating features is that, with this construction, the total expansion of the pistons is more than twice as great as can be obtained by any other design. In breaking the coal down an expansion in excess of 3 inches is often required. In the standard bar, 4½ inches in depth, the combined expansion of both pistons is nearly 4⅞ inches. This insures ample expansion to make the coal fall after it has been broken and shattered. An expanding bar of this type is practically indestructible, requiring no maintenance cost, except possibly the renewing of the leather gaskets after a long period of use. The end of each telescopic piston (one bearing against the coal and the other against the roof rock), is enlarged into a flat bearing surface 5 inches square. This large bearing surface prevents indentation. Even in the softest coal indentation of any piston does not exceed ⅛ inch, when exerting full expanding force.

(3) Piston Valves.

The enormous force exerted by each piston precludes the use of holding in bolts, of any description, to prevent the further ejection of any one piston, after it has made its normal outward travel. At the same time, some means must be devised to maintain constant water pressure on each piston, that may be only partially ejected, in the event that one piston completes its outward travel. In other words, each piston must continue to exert its full pressure, independent of what any other piston may be exerting, or the distance it has traveled. This operating characteristic must be made "fool proof." This is done by providing each piston chamber with an automatic cut-off valve, actuated by the movement of the piston. This valve is very simple and effective in construction, and operates to shut off the water supply to the piston chamber at the instant the piston has made its proper, normal, outward expansion. The cutting off of the water supply to any particular piston chamber does not effect in any way the pressure exerted by any other piston—the other pistons continuing to be ejected at full pressure until they are fully expanded, should this be necessary.

(4) External Control Valves.

In the application of the bar it is very necessary for the operator to be able to control the ejection of the pistons. At certain times during the breaking down process, more satisfactory results are obtained by retarding the ejection of certain sets of pistons, or in some cases stopping their ejection entirely, for a few seconds, while other sets of pistons are being ejected at normal speed. To obtain these operating features, separate water passages are provided, leading to certain sets of piston chambers, the water supply being controlled by separate external valves. In the small size, No. 1, type of bar, the three end pistons, or those located in the short side of the "L" shaped bar, are controlled by one valve, while each set of two pistons in the long side of the bar is controlled by separate valves. These controlling valves are placed in a "valve head," attached to the bar externally, at a safe distance from the "face" of the coal, so that the operator is in no danger of being injured when the coal falls and topples over.

In the large size bars, made in two sections, the pistons in the short section which parallel the back wall of support, are controlled by one external valve, as the separate control of each piston or set of pistons in this part of the bar, is not necessary. In the section which parallels the "rib" wall, however, it is necessary to control at least each set of two pistons, and in some cases each of the first two pistons, separately; that is, the two nearest the face of the coal. This is necessary for the reason that the front pistons have very much less work to do than those further back in the coal, and the speed of their ejection must be retarded, and at times stopped entirely, thus throwing full pressure on the back pistons for such period as is necessary to shear the coal at the back first. Better results are obtained by keeping the body of coal together in one mass until it is ready to fall, rather than "shelving" it off in sections, as would result if the ejection speed of the forward pistons were not controlled. After the two sections of the bar are placed in the slot, the feed pipes, or water passages, leading to the piston chambers, are connected together externally by a special "T" so that both sections of the bar are operated simultaneously from the same water supply and in the same manner, as if both sections were one bar. By reason of being able to control the ejection of the pistons in this manner, the operator is enabled to produce, and control the application of the forces, at such times, and in such a manner, as to produce certain and definite results. The coal characteristics determine, in a large measure, the manipulation necessary to produce the best results, and also the operator, by observing the progress and conditions, as the forces are applied, can determine, from experience, when, and to what extent, the various sets of pistons should be brought into action, or otherwise controlled. After a very brief experience the operator can apply the forces of the bar in a manner that will insure uniform results and cause the coal to be broken up to almost any extent desired, by the time it is ready to fall, thus making it easy to load out. If necassary each piston, or set of pistons can be so manipulated as to cause a definite fracture of the coal immediately in line with the force applied, and in this manner produce a large number of separate lumps. This is only necessary, however, in coal that contains a comparatively small number of cleavage planes, or "slips." In fully 90 percent of the ordinary bituminous or lignite coals there is always found a large number of these natural "slips" and as the forces always shatter the coal along these planes or "slips," it is very seldom necessary to manipulate the ejection of the pistons to break the coal into smaller lumps. In practice, after the bar is inserted, water is admitted to all the piston chambers, and these are ejected until sufficient pressure is developed to cause the coal to commence to "work"; that is, begin to crack and boom. The whole mass is then under the enormous internal stresses. This stage is reached, usually, when the water pressure is between 3,000 and 4,000 pounds and the bar developing a total force of about ⅓ to ½ million pounds. The valves controlling the ejection of the front pistons (that is, those nearest the face of the coal, which, of course, have very much less work to do and require less pressure), are then partlaliy closed, or if the coal shows any tendency to shelve off the front, closed entirely. The back pistons; that is, those paralleling the back wall of support, and the rear two or more paralleling the "rib" wall, continue to be ejected until a definite fracture occurs along the back and side walls. When this occurs the operator need not be told what has happened, as this is accompanied by a loud "boom" that indicates a definite fracture. The booming noise is simply due to the slipping of the fracture, as would occur in breaking a huge beam of wood, under similar conditions. The front pistons are then again brought into action and the coal cracked and broken until it falls. In producing the enormous forces necessary to make clean-cut fractures along the walls of support, the water pressure is often 10,000 pounds per square inch, or even greater, and at this pressure the force developed by each piston is from 150,000 to 192,500 pounds. The hydraulic bar is designed for 15,000 pounds per square inch water pressure, but will stand 20,000 pounds without injury. When the bar is inserted in the center slot, the manipulation is practically the same, the only requirement being that the front pistons be not ejected too fast, until the back pistons produce a definite shear along the back wall, and after this is done the coal will usually fall without any further manipulation. If the coal has a tendency to stick to the roof, the front pistons are ejected until it is torn off and toppled over. From the above the great advantages to be obtained by the use of this form of bar are apparent. The ability to control the ejection of the pistons is of the **greatest importance** in the successful application of this process of mining. It permits of the forces being applied scientifically, where and when required, producing results that are uniform, and which can be obtained in no other manner.

These special and particular operating and constructional characteristics **produce and insure** results that are **mechanically and scientifically impossible** in any other form, or type, of expanding bar. They solve the problem of applying mechanical forces for the mining of coal.

(5) Spring Return of Pistons to the Piston Chambers.

At the moment the coal falls, the pistons are ejected at least one-half their normal travel and in some cases as much as 3½ inches or even 4 inches. In this condition it is very difficult to extract the bar from the fallen coal, as these projecting pistons occupy, in a large measure, the space the coal has fallen. Also the fallen coal is broken up and there are large cracks and crevices which interfere in the withdrawal of the bar, as long as the pistons remain expanded. It is, therefore, very important to provide some means for rapidly collapsing the pistons, thus reducing the bar to normal thickness, and allowing ample space for its being withdrawn freely. Also, with the pistons collapsed, the surface of the bar is perfectly smooth, and there are no projections to get caught in the cracks and crevices of the broken coal. To provide for the return of the pistons to their collapsed position **quickly**, powerful springs are provided which, as soon as the water pressure is removed, force the pistons back into the piston chambers. This action is assisted somewhat by the suction of the pump which, at that time, is removing the water from the piston chambers and pumping it back into the supply tank. This suction effect is, however, comparatively feeble, as the pistons of the high pressure pump are very small and not suitable for creating a vacuum. Also, unless special gaskets are provided on the bar pistons, air can pass freely into the piston chambers and destroy any suction effect. The introduction of special gaskets to prevent this, complicates the piston construction, so that the action of heavy springs is depended upon for forcing the pistons back into their chambers. In the collapsed position, each piston is held firmly in its chamber, with a force equal to from 12 to 14 times its weight. As the piston is ejected, this force increases slightly, but the force of the spring action is practically constant. This is accomplished by using a compression spring in combination with a lever action, the fulcrum of which is shortened, in proportion to the travel of the piston, as it is ejected. This spring action has been very carefully worked out, as it is of considerable importance in saving time and annoyance in handling the bar and in permitting of the bar being extracted from the slot, readily and quickly, after the coal has fallen.

(6) Special Designs.

In some cases and under certain conditions it is advantageous to produce a combination of stresses, part of which are in a vertical plane and others in an angular plane. The result of this combination is to produce shearing stresses in the coal that insure its being shattered in many different directions. Also, when the rooms are turned down the "pitch", or other conditions make it necessary, the coal can be given an outward thrust, as well as downward, thus causing the coal, as it falls, to roll outwardly. To produce these various results, the pistons are set in the bar at an angle of from 10 to 22 degrees, the direction of ejection being **downward and outward,** producing what may be termed, "angular displacement" of the applied forces. To appreciate the effect of the application of the forces applied in this manner, consider the body of coal as a beam rigidly supported at both ends and along the back wall. As the pistons are ejected, they cause a rotating, or twisting, of this beam, and develop **enormous torsions** that twist and rend the mass, producing fractures along all the seams of less density and thickness, as well as along the natural "slips". In some cases part of the pistons may be placed in the bar at a given angle, while the others remain vertical. By shifting the angle of application of the forces, or by the combination of vertical and angular forces, such stresses may be set up in the body of coal as to produce almost any desired result. The bearing surfaces of the pistons, which are placed at an angle in the bar, are also of special design.

This construction is made possible only by reason of the use of reaction type pistons. In any other form of piston, the bar would be distorted, due to the angular displacement of the piston reactions, to such an extent as to make it impossible to apply the forces exerted, in this manner. This type of bar is used only in coal that is very solid, homogeneous in character, and where it is necessary, or desirable, to have the coal broken up to a much greater extent than would be produced by the use of straight, vertical type pistons. If this type of bar is used in coal having the usual number of natural cleavage planes, or "slips", it will cause the coal to be broken into small lumps, or "sheets", producing a greater percentage of slack coal than would be produced by the standard bar, which is normally less than 10 per cent, in a 6 foot vein. The placing of pistons in an expanding bar at an angle is an entirely new form of application and produces results that have never been possible in any other type of expanding bar. Also the ability to give the coal an outward rolling action is, in some cases, of great importance. The conditions which require this type of bar area, however, very unusual, as normally the standard type of bar fulfills every requirement. The development of this type of bar further extends the field for the introduction of this process of mining, enabling it to be successfully used under the most adverse conditions, and further permitting of variations in design, adapted to the character of coal in which the expanding bar is to be used.

The Hydraulic Pump.

The water pressure for ejecting the pistons of the hydraulic bar is obtained from a small triplex or quadruplex pump, driven by a 2½, 3, or 5 horse power, variable speed motor, depending on the size of the bar used. These pumps are manufactured by a number of different companies in this country and have no special features. The normal working pressures are ten thousand and fifteen thousand pounds per square inch, and the capacity is such that the bar can be fully expanded in from 4½ to 5 minutes. Usually the coal will fall when the pistons have been ejected about two-thirds of their maximum travel, so that the average time required for one "shot" is from 2 to 3 minutes.

Folding Steel Tubing.

The water is conveyed from the pump to the expanding bar through specially designed, folding steel tubing. This tubing is ¾ inch outside diameter and is cut into lengths of from 20 to 24 inches, and these lengths joined together by means of a special universal joint. The joint is so constructed that it permits of the tubing being folded up like a clothes rack. The joint is very simple in construction and absolutely leak proof. It represents the result of over two years designing and experimenting in perfecting this means of conveying water, at very high pressure, from a stationary pump, to the expanding bar. The joints are of chrome vanadium, heat treated steel, which permits of their being very light in weight. The standard length, unfolded, is 21 feet. Connections between the bar and pump can be made at any distance, from a few inches up to the total length, by simply unfolding the amount of tubing required. A length of 21 feet of this jointed steel tubing with the flexible joints, weights about 30 pounds. The tubing and joints are indestructible and require practically no maintenance cost. Each length of tubing is designed for a working pressure of 30,000 lbs., water pressure, per sq. inch. The tubing is very high grade tool steel and is very stiff and substantial. One end is provided with a special coupling for attaching to the "valve head" of the hydraulic bar, while the other end is permanently attached to the discharge of the high pressure pump. This means of conveying water from the pump to the bar has proven very satisfactory and has never failed, or caused a moment's delay, in three years of service. The joints are easily taken apart and the leather gaskets renewed should this ever become necessary. The water, or "water emulsion" as it is called, containing just sufficient oil to provide lubrication and prevent rusting, is carried in a ten gallon tank. After the hydraulic bar has been expanded and the coal brought down, the emulsion is pumped back into the tank. The only loss of the emulsion is that due to making connections and the drippings. A ten gallon tank will mine from 1,000 to 5,000 tons.

The "emulsion" in the tank is put under a pressure of 150 pounds by air pressure, and as practically the same amount of fluid is pumped back into the tank after each expansion of the bar, this air pressure remains fairly constant after once being pumped up. A small power driven air pump can be used to furnish this air pressure or it can be pumped up by hand. As soon as the bar is inserted and the jointed tubing connected, the valve connecting the supply tank to the suction end of the high pressure pump, is opened, and the fluid passes through the pump valves and jointed steel tubing, into the piston chambers, thus completely filling the entire expanding mechanism, before the high pressure pump is started. This saves time and also "sets" the pistons. In the No. 2 bar, at 100 pounds pressure, each piston is exerting a force of 1,300 pounds, or the total expanding force of the bar is 13,000 pounds. With the pistons exerting this force, upon the application of the tank pressure only, they are "seated" ready to receive the pump pressure at the first stroke of the pump pistons. In the No. 2 size bar, each

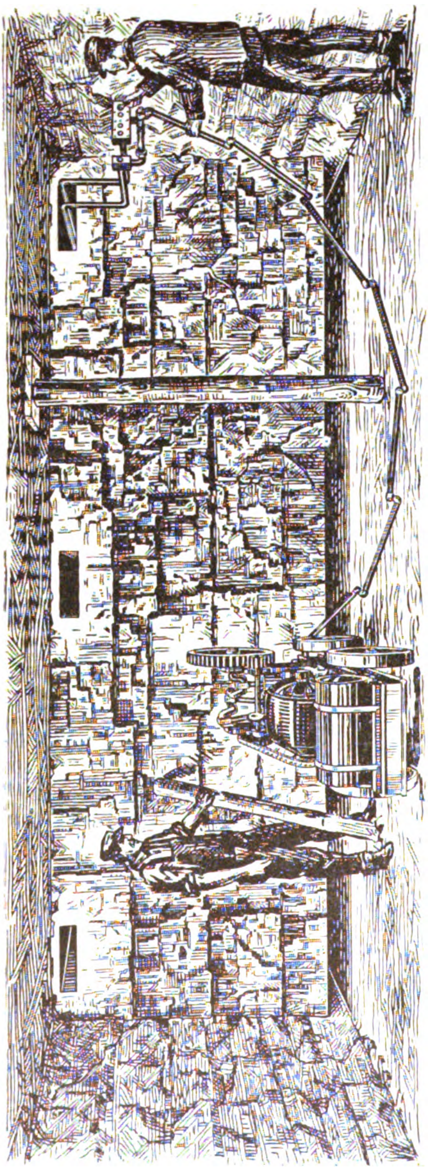


FIGURE 1—Complete breaking-down equipment ready for operation. Folding steel tubing conveys water at high pressure to Hydraulic Expanding Bars.

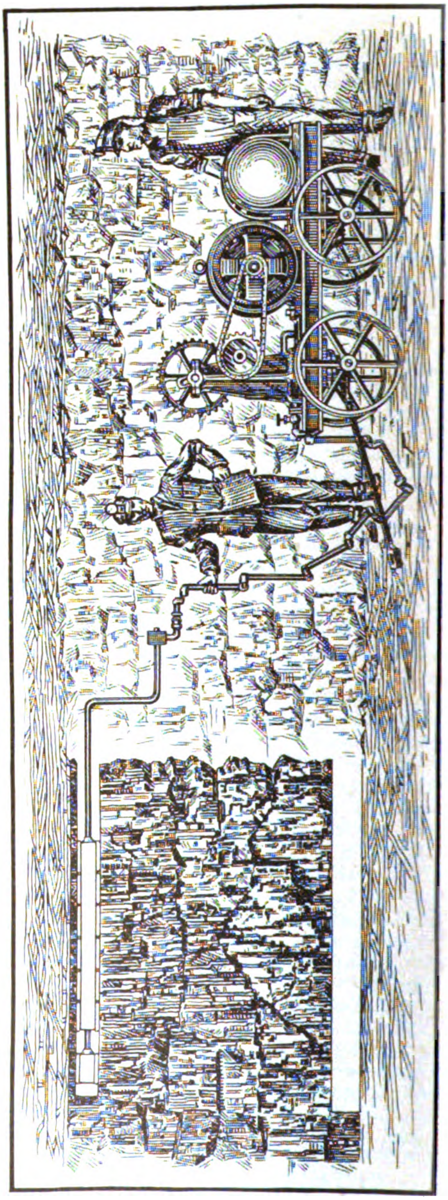


FIGURE 2 Side view showing Expanding Bars in position in slot. One man is operating valves controlling ejection of [illegible] while the other regulates speed of pump. One bar is shearing coal off the back wall of support, while the [illegible]

stroke of the high pressure pump causes the pistons in the bar to be ejected, seventeen ten-thousandths of an inch. At normal speed the pump makes five hundred strokes per minute. Each stroke drives the pistons of the bar against the coal with a combined force equal to one million, five hundred thousand pounds! Conceive of this force being delivered to the mass of coal at the rate of five hundred impulses per minute and you will have some idea of the enormous shattering effect produced. The rapid application of these enormous impulses, causes the complete disintegration of the coal, not only at the point of application, but

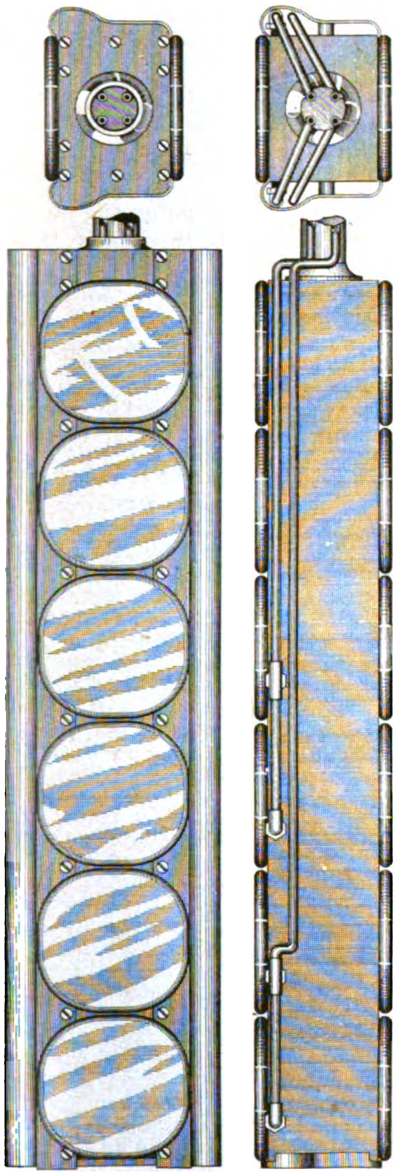


FIGURE 3 (above)—Top view of long section, No. 2 size bar showing shape of bearing surfaces of pistons. Total exertive expanding force of No. 2 bar is 1,500,000 pounds at normal water pressure.
FIGURE 4 (above)—End view showing side plates or covers enclosing steel tubes that convey water to piston chambers.
FIGURE 5 (lower)—Side view of No. 2 bar—sideplates removed—showing steel tubes that convey water to last four pistons. Depth or thickness is 4½ inches, allowing insertion into slot cut 4¾ inches by 20 inches, and 5 to 6 feet deep, depending on undercut.
FIGURE 6 (lower)—End view, with end enclosing plates removed.

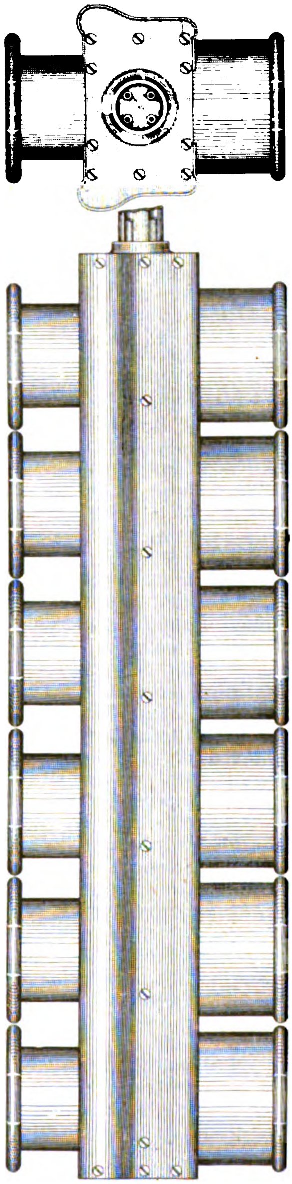


FIGURE 7 (left)—No. 2 size bar with both major and reaction pistons fully ejected. Side enclosing plates in place.
FIGURE 8 (right)—End view of bar. Pistons fully expanded.

throughout the mass to a surprising distance, often ten to fifteen feet distant, from the point of application. A peculiar fact in this connection, is that the harder the coal and the greater the force required to shatter it, the larger the volume of coal that will be broken at one application, and the more completely it will be broken up when it finally falls. The same effect has been noted in breaking wood beams, as the harder and more rigid the wood, the greater the load required, and when the beam is finally broken, it will be more completely shattered than a beam of less rigidity.

General Operation.

The tank, pump and motor are mounted on a small portable truck which is atached to the self-propelling slotting machine as a "trailer" and conveyed from place to place in the mine. The hydraulic bar is also carried on this truck. The slotting machine, with its trailer, carrying the pump, the hydraulic bar, the folded steel tubing, and other fittings and tools, is one unit. The process of slotting the coal and breaking it down is carried on as **one operation.** It requires three men, one of whom acts as "nipper" when the equipment is moved from room to room, and as general helper to the other two, while working in a "place". The usual procedure, on arriving at the face of the "room", is to detach the "trailer" from the slotting machine and push it to one side. The slotting machine then proceeds to cut a slot, on, for instance, the right hand "rib" side of the room, and as soon as this is done, requiring from five to seven minutes, it then moves to the center. As soon as the first slot is cut, the other two men proceed to insert the bar and bring down this section of the "room". In the meantime, the center slot is cut and ready for the bar, and the slotting machine proceeds to cut the last, or third slot, on the left "rib", while the center section is brought down. In this way the entire breaking down process is completed at one time, requiring not to exceed thirty minutes. In veins of 7 feet or less, in rooms, three slots only are cut, as close to the roof as possible, one in the center and one close to each "rib". When necessary, additional slots can also be cut, approximately halfway up the vein. This is only necessary in high veins, 7 feet or more in thickness, or where, on account of unusual local conditions, it is desirable to break down half of the vein only, at each application. In cutting these additional slots, the machine is not moved, as the only adjustment necessary is to raise, or lower, the cutter bar, both slots being cut with one "set up". After the slotting machine is once locked in position, the cutting of the additional slot requires only 3 to 5 minutes, as the cutter bar is quickly raised, or lowered, the required distance by the hydraulic rams,. and the bar inserted and withdrawn. In rooms 20 feet or more in width, where the coal is well stratified, or has the usual "slips' and cleavage planes, it is very seldom necessary to cut more than the three slots up against the roof, even in veins 8 to 10 feet in thickness. In driving entries, and narrow places, three slots are cut, two near one "rib" wall, one of them near the roof and the other halfway up the vein, while the third is cut near the roof and the opposite "rib". The hydraulic bar is first inserted in the lower slot, and the coal broken down, then inserted in the slot near the roof on the opposite "rib", and lastly in the top slot on the same " rib" as the first application. This breaks the coal down in three sections, at the same time shearing it off squarely along both "ribs" and the back wall of support. If necessary, in narrow entries and high coal, four slots can be cut, that is, one above the other on each "rib", and the coal broken down in four sections instead of three. It is not necessary to put in a center slot in "places" twelve feet or less in width.

In long wall mines, the first slot is cut near the "rib" and the coal sheared off and broken down to whatever distance it may break. The next slot is cut from 15 to 25 feet beyond where the coal has fallen with the first application, and so on, each successive slot being cut only after each application. The number of slots required depends on local conditions and character of coal, usually spaced from 30 to 50 feet apart. Also, in long wall mining, as soon as one-half of the coal is loaded out, this section of the "long wall" can be again cut and broken down while the other half is being loaded out, and thus the three operations of extraction—undercutting, breaking down, and loading out—can be carried on without interruptions, or interference with each other, resulting in continuous, uniform output. In "room and pillar" mining the same routine of operations is carried out. Where the men are skillful and become familiar with the procedure, it is estimated that, including moving, etc., three men will break down ready to load out, from eight to twelve "places" per day, producing from two to three hundred tons, or an average of over seventy-five tons per day, per man employed.

(To be continued in May issue.)

Some Notes on the Operation of a Portland Continuous Filter in Costa Rica, Central America

By H. H. Juchem, '10.

In considering the following notes on a Portland Filter Unit, it must be borne in mind that the men employed in the operation of the filters are absolutely inexperienced and ignorant so far as machinery of any kind is concerned. They are peons from the fields for most part. Rarely has one of them enough mechanical sense or application to learn the work. From hundreds of men, a few efficient cyanide plant men have been developed.

It must be remembered, also, that the filters have to work under tropical conditions, four months of extreme drought, and eight months of dampness. These tropical changes of climate have a direct bearing on the cost of operation and maintenance.

It should be noted that the material treated averages only 6.5 percent coarser than 100 mesh. However small the hole which develops in the filter medium, a certain amount of grit goes through the valves and vacuum pumps. On the other hand, classification to slime without grit. cuts down the capacity of the filter and runs up to dissolved values in the tailing.

Equipment.

A unit includes one 7½ x 12 ft. Portland Filter; 6-in. x 6-in. American air compressor; 4-in. x 4-in. Connersville Rotary Vacuum Pump; air receiver, motor, etc.

Operating Data.

(1) The conditions held: 10 lbs. air is maintained in the receiver; 15 to 20 inches vacuum is carried on the pump, depending upon state of wear of the pump and valves. The vacuum pump for 4½ years lifted the solution to a height of 9 feet above the level of the center of the pump. The pressure has since been taken off the pump, because it would not give the required vacuum nor perform the lift on account of wear; 2 to 5 lbs. air pressure is carried in the discharge pipes of the filter.

(2) The tonnage treated averages 991 tons dry material per month.

(3) The slime of 1.456 specific gravity (sp. gr. of dry ore is 2.63) is treated by filter. Screen analysis of the material treated averages:

On 80 mesh........	2.5 percent
On 100 mesh........	4. percent
On 150 mesh........	6.5 percent
On 200 mesh........	5. percent
Thru 200 mesh........	82.0 percent

(4) 8 to 13 gallons of solution is discharged by vacuum pump. This depends upon the state of the filtering medium. Only one solution product is made.

(5) The dissolved value in the tailing runs $0.03 to $0.05 per ton of dry slime.

(6) The tailing is sluiced to the river.

(7) The average total cost of filtering, including operation, repair, maintenance, but not power nor superintendence, is $0.028 per ton filtered.

Life of Various Parts.

Thirty-five hours are required to recover the filter. This includes taking off the old wire, cloth and burlap, removal of all screens and cleaning by hand, sluicing out of solution pipes, re-assembling, recovering and rewinding. Valves, gears and the pump are always gone over carefully and the necessary repairs made.

(1) The life of the valve plate and seat averages 4½ years without regrinding or scraping. The life thereafter dedepends on the skill of the mechanic.

(2) The life of the hose from the valve plate—no replacements.

(3) The life of the vacuum pump on this duty is about five years. Impellers and case become worn by sand, and pinions wear out.

(4) The valves of the air compressor last about four years.

(5) A new soft iron scraper, to remove the tailing, is replaced about every four months.

(6) A filter cover lasts eleven months. One set of burlap undercovers lasts twenty-two months.

(7) The wire winding is generally changed with the cover, though on two occasions it was used over with no trouble except in rewinding.

(8) The main driving gear lasts three years.

(9) The main driving worm lasts thirteen to fifteen months.

(10) The main driving gear and pinion—no replacements.

(11) After five years the wooden parts showed no deterioration except a few worm holes which were stopped with tar and rosin. Those holes were made during a two months' shut-down.

Manipulation.

(1) The scraper plate tails are filed flat every shift (12 hours).

(2) The slime is agitated every two hours.

(3) The slime is pumped from the bottom of tank by air lifts twice each shift (12 hours).

(4) The vacuum is cut off and ten lbs. of air blown through the ports after every two shifts for one revolution of the filter.

(5) The filter is cleaned every two weeks. When the discharge drops to 8 gals. per min. the filter is cleaned. The cover is brushed with fiber brushes and then steel brushes until it is clean. It is then given a wash of 50 gallons of 2½ percent. hydrochloric acid with the vacuum and air pressure on. Acid is left on for 15 minutes, and then washed off with water. The tank is sluiced out. The operation takes two to four hours from the time of taking off the vacuum to the time of removing the cake off the clean filter.

(6) When first erected, the solution distributor did not work well. It was removed and a solution applied in a fine spray. The spray was very satisfactory so far as replacement of pregnant solution was concerned, but it could not be regulated to such a point that it washed well and at the same time did not dilute the pulp in the tank and channel the cake. The distribution pipe was replaced after having been bent so that it would distribute evenly. A constant pressure was kept on the valve; for with variable pressure the distributor gave an uneven wash and the pressure was different than that for which it had been regulated. The distributor was placed very close to the cake so that the solution ran down in a continuous stream and did not drop on the surface.

A burlap drag was placed in front of the solution distributor at a distance of two feet. This drag is merely a pipe with a 6-inch width of burlap fastened to one edge, the other edge of the burlap touching the cake the whole width of the filter. Sufficient solution is used to cover the whole space between the drag and distributor. Below the drag the solution thus regulated covered the cake in streaks for 2 feet or more and then disappeared.

The object is this: From the surface of the charge to within a foot of the drag, the pregnant solution most loosely held is removed. The barren solution wash then spraying upon the pregnant solution remaining replaces it. After passing the distributor the cake comes under the water spray and the barren solution is replaced by water. This seems exaggerated, but the results show that this is very nearly what takes place. Without the drag, covering the entire surface of the cake with solution wash from the surface of the filter charge to the distributor, the dissolved value in the tailing runs up because of channeling by the large amount of solution running down the filter face. The capacity of the filter is cut down by the dilution of the charge by the excess barren solution.

(7) Water wash is applied in four four sprays. The water strikes the cake 6 inches from the solution wash distributor.

(8) The holes in the filtering medium are covered by a square cloth (same as filter cover) ½-inch square or longer, depending upon the size of the hole. These cloth squares are simply slipped under the wires without stopping the filter. When the cover is cleaned all the holes not previously caught are repaired. Holes which do not show while the cake is on the filter are found by putting on the water spray and blowing through the air port. Patches two feet square have been made by this method. No slime leaks through, and the cake is as thick over the patches as over the unpatched surface.

(9) When the wire breaks, during winding or when an end is reached, six inches of wire are worked back under that already placed, selecting a cleat on which to make the joint. Six inches of wire, about to be placed in position, is warped in beside the end of the wire already wound on the filter and the two tacked down to the cleat by staples. One turn of the filter is then made with the new slack wire even. Then pressure is applied and the winding continued. A piece of tin sheet 1 inch by 6 inches is placed over the tacked point beneath the wires. When a worn turn of wire breaks it is cut off at the soldered cleats, a new wire placed and the joints made as outlined.

(10) If the proportion of gritty material in the discharge is too small to allow good washing of the cake, a little sand is added in the tank.

(11) If the charge becomes too thin because of an excess of solution wash, 10 or 15 gallons of lime water are added to the charge and the filter run without solution wash, the valve on the vacuum line corresponding to the position of the solution wash on the filter is closed and the charge is not agitated until the thin pulp on top of the charge has been removed. This is, of course, a matter of settling the slime and pulling out the supernatant liquid. The overflow pipes and pump are not used. Whatever goes into the tank remains and is subsequently separated into tailing and solution.

The Occurrence of Gold and Silver in the Ferberite Deposits of Boulder County, Colorado*

With each depression in the tungsten market statements have been made that if the gold and silver in the ferberite ore of Boulder County, Colorado, could be saved, the tungsten industry would be helped considerably. Considerable doubt existed whether gold and silver occurred in quantity in the ferberite veins of Colorado. Accordingly, samples from several parts of the ferberite district were analyzed. No gold was found and a small amount of silver in only two samples. The work stopped at this point, there apparently being no problem of recovery, so that the results given here are negative.

The occurrence of silver and a trace of gold is reported by W. E. Greenawalt[1] in three samples of concentrate:

	Bear Creek	Nederland	Gorden Gulch
WO_3	66.41%	63.20%	60.84%
Gold	Trace	Trace	
Silver	1.2 oz. per on	2.4 oz. per ton	3.1 oz. per ton

W. Lindgren[2] states that the telluride veins of Boulder County have an intimate relationship to those of Cripple Creek, but that the tungsten veins of Boulder County do not contain any notable amounts of gold and silver and are entirely distinct from the gold and silver veins.

R. D. George[3] reports the occurrence of ferberite with telluride ore in the Graphic Mine, at Magnolia, and also in a mine near Sunshine. The Wellman Tunnel shows both ferberite and sylvanite.

V. G. Hill[4] found an average of 0.01 ounces of gold per ton in eight samples of concentrate.

Gold is said to be sometimes found with ferberite in the Logan Mine, at Crisman.[5]

F. L. Hess and W. T. Schaller[6] state that gold and silver are reported to occur in some of the ferberite veins other than those in which sylvanite is present. In an ore of this character which was examined small quantities of sulphide were found, and the gold is probably associated with the pyrite. They report the occurrence of small quantities of gold and silver in tungsten veins to be fairly common, but in many if not in most veins the precious metals, though of the same general period of vein formation, are probably of later deposition than wolframite. Silver seems to occur in larger quantities than gold.

Mr. George W. Teal,[7] president of the Slide Gold Mining Company, states that he knows of only two veins in the county where gold and tungsten occur in appreciable quantity in the same vein. He probably refers to the Red Sign Mine, located in Boulder Canon about six miles from Boulder. From this ore concentrates were obtained containing 30 per cent WO_3, and 15 to 20 ounces of gold per ton, but the quantity was not great enough to warrant erection of a plant for separation of gold and tungsten. He is of the opinion that there is not a deposit of ferberite carrying gold so far discovered in Boulder County, which is of sufficient grade or quantity to warrant any experimental work for the purpose of working out a process for separation.

In the operation of the concentrator of the Tungsten Products Company, Mr. Warren F. Bleecker[7] was found that if gold occurs in the concentrate from wet concentration, it is in sulphides. The ores concentrated were from various parts of the county, but particularly from the district near Boulder. The products of wet concentration have been subsequently passed over a magnetic separator, which results in a separation of tungsten from the gold and the iron sulphide from any free gold. He has found that the concentrate of gold obtained by magnetic treatment run in all cases less than 1 ounce of gold per ton, but usually more than 0.75 ounce of gold per ton. The concentration is several hundred into one. Chinese wolframite and Arizona hubne-

* A contribution from the Department of Metallurgical Research, Colorado School of Mines, Golden, Colorado.

[1] The Tungsten Deposits of Boulder County, Colorado. E. & M. Journal, May 18, 1903, page 951.

[2] Gold and Tungsten Deposits of Colorado. Economic Geology, August, 1907, page 453.

[3] Main Tungsten Area of Boulder County, Colorado. Colorado Geological Survey, Report 1908, page 76.

[4] Tungsten Mining and Milling. Proc. Colorado Scientific Society, Vol. IX, 1909, page 150.

[5] Bul. No. 3, 1912, Colorado Metal Mining Association.

[6] Colorado Ferberite and Wolframite Series. U. S. G. S. Bul. No. 583, 1914, page 12.

[7] Personal communications.

Tungsten, Gold and Silver in Boulder County.

Ferberite Ore and Concentrate.

Sample No.	Description	Percent WO_3	Oz. Gold Per Ton	Oz. Silver Per Ton
1	Crude ore, finer, Tungsten Products Co......	31.2	Trace	Trace
2	Crude ore, coarse, Tungsten Products Co....	7.8	Trace	None
3	Crude ore, Black Metals Reduction Co.......	25.8	3.2	Trace
4	Crude ore, Black Metals Reduction Co....... (From Wolfe Tongue Mining Co.)	42.3	0.06	Trace
5	Saunder jig hutch	62.4	Trace	None
6	Crude ore, Kicker Mine.....................	23.1	None	None
7	Richards jig hutch	46.8	None	None
8	Crude ore, Hoosier Mine....................	54.3	Trace	Trace
9	Jig concentrate, Clyde Mine ore............	58.2	Trace	Trace

rite do not carry as much gold as even the small quantity found in Boulder County ore.

Gold and silver has never been found to occur in appreciable quantity in the ferberite ores mined on the properties of the Wolf Tongue[8] Mining Company, near Nederland.

[8] Personal communications, R. E. Ewalt.

Samples analyzed confirm the general trend of opinion of operators and others in that silver occurs with ferberite only in rare instances, and then not in large quantity, and that gold rarely occurs in greater quantity than a trace in crude ore. This indicates that sylvanite is rarely found with ferberite in Boulder County and that any gold and silver present is probably associated with sulphides.

A MAMMOTH GRAIN ELEVATOR.

The immense grain elevator of the Pennsylvania Railroad at Canton, near Baltimore, one of the largest on the Atlantic seaboard, began operations with a successful testing out of the machinery and a trial with a large amount of grain, which has been received there.

Baltimore grain merchants are anticipating the full operation of the elevator in a short time, and it is expected that the facilities for speed in loading and unloading grain will add impetus to the export of grain from Baltimore. The elevator has a capacity of 4,257,900 bushels, whereas the other seven elevators now in use here have only a total capacity of 10,000,000 bushels. The grain storage capacity at the railroad terminals, therefore, will be increased nearly 43 per cent.

This monster grain elevator is equipped throughout with elevator and conveyor belting made by the B. F. Goodrich Rubber Company. This represents the largest single order of belting ever shipped, and it required seven box cars to transport it from Akron to Baltimore. The belting totaled 44,254 feet—approximately 8½ miles—and weighed 131 tons. The capacity of one of the 48-inch horizontal carrier belts is 350,000 bushels in a ten-hour day.

Accommodations are provided for the loading of five ocean liners at once and, with the new apparatus for loading that has been installed, the ships can be loaded within 10 hours.

In conjunction with the facilities that have been made for handling ship cargo, the latest device for the unloading of grain railroad cars has been put into operation and found to have proved a large factor in the expeditious handling of incoming grain from the Maryland, Virginia, West Virginia and Middle Western districts.

GEOLOGICAL FOLIO SALE.

The Geological Survey is offering for sale at the nominal price of 5 cents a copy, a considerable stock of slightly damaged geologic folios covering various parts of the United States. The damage to the folios, only slight, resulted from a fire some years ago. The list price of these folios is 25 cents and 50 cents a copy. A list showing the folios available at this 5-cent rate will be furnished on application to the Director, United States Geological Survey, Department of Interior, Washington, D. C.

LARGE MAP OF ARIZONA.

A new and accurate map of the State of Arizona has just been compiled and printed by the United States Geological Survey, Department of the Interior. The map measures 4 feet by 4½ feet; it is printed in black, and shows the county and township boundaries, the names of all towns and most of the names of even the small settlements, the railroads, all rivers, and many of the smaller streams and water features. The map is sold by the Geological Survey, at Washington, for 35 cents.

TECHNICAL REVIEW

GENERAL.

Transactions American Institute of Chemical Engineers, 1919.

We are just in receipt of the eleventh volume of the Transactions of the American Institute of Chemical Engineers, 1918, published by D. Van Nostrand Company, which is well worth giving some thoughtful attention. The conditions in which we find ourselves now that the war is over require careful handling, and the "Human Element" between employers and employes is one of the uppermost in which case Bolshevism would be forgotten.

The results of Alfred H. White's research in Nitrogen Fixation appears in print by the permission of the Chief of Ordnance.

Walter M. Russell takes up the subject of coal and water gas plants, illustrates the article, and mentions improvements. The United States Patent No. 688,872 on the manufacture of sulphuric acid by the multiple tangent system is described in detail by L. A. Thiele.

The reconstruction aspects to be found in this volume are well worth considering, especially with reference to the preservation of our chemical industries and research together with our relations scientifically to foreign countries. P. G.

"Selling Your Services."

Published by Jordan-Goodwin Corporation, Jefferson Bank Building, New York. Price, $2.00.

For the man who has no job, the man who has not the kind of job he desires, and the man who feels he has reached his limit in his present job, Mr. George Conover Pearson's new book, "Selling Your Services," will be of real benefit.

Knowing that the same fundamental laws that are effective in selling any product apply equally well to selling a man's services, Mr. Pearson has given in simple, practical, usable form, plans that any man can follow to conduct a resultful campaign to sell his own services.

Such a book is of widespread interest today because many returned service men are still out of employment, and many of those who have secured work have had to accept jobs that do not give them a real chance to develop according to their ability.

The book is filled with practical examples of advertisements, circular letters, application letters, follow-up letters, and telegrams, most of which has been actually used in obtaining better opportunities for bookkeepers, salesmen, sales managers, foremen, accountants, advertising managers, clerks, stenographers, editors, etc. It is presented in very readable form and is completely indexed.

C. E. W.

Herbert Hoover: A Sketch. By T. A. Rickard. (M. & S. P., April 3, 1920.)

This timely article on the new president of the A. I. M. E. quite properly begins with his parentage. His college career, and first job at Grass Valley, California, are next mentioned. Later he became an engineer for Louis Janin, and was sent to Western Australia. At the age of 24 he was chief engineer for the Chinese Imperial Bureau of Mines. His public prominence was emphasized by his assistance of Americans stranded in Europe, 1914. Since then he has been head of the Commission for Relief in Belgium, U. S. Food Administrator, and head of the American Relief Commission.

J. H.

Political and Commercial Control of the Nitrogen Resources of the World—I. By Gilbert G. Chester. (C. & M. E., March 10, 1920.)

This is a general review of the sources of nitrogen with the aspects of the control of nitrogen resources in normal and war times. Free nitrogen forms four-fifths of our atmosphere, but this cannot be used until it is combined with other elements, a reaction which it does very unreadily. Mineral nitrates have an uncertain origin, which may be best investigated in Chile, where the greatest nitrate deposits are. Organic nitrogen forms the greatest part of commercial fertilizers. Carboniferous deposits always contain a variable quantity of nitrogen. The universal availability of the nitrogen resources makes it impossible for any one nation or company to gain control over them. Although the mineral nitrates of Chile are controlled by that state, and lie, in time of war, at the service of the nation which controls the sea, the other sources of nitrogen are so great that no country need fear a shortage. J. H.

Review of the Copper Industry for 1919. (Arizona Mining Journal, March, 1920.)

In this article, a statistical review is given, by the Boston News Bureau, of the world's chief non-ferrous metal. These articles include the copper production of the greatest copper companies, the statistics on refined and blister copper, copper exports and smelter production in the United States. The production of gold and silver, obtained from copper ores, is also given. F. A. L.

The First Miners and the First Civilization. By Grant H. Smith. (M. & S. P., March 27, 1920.)

This article affords a pleasant view into classical antiquity after too close proximity to the cold science demanded by modern mining and metallurgy. Among the first miners are placed the ancient miners of England who mined for flint ten thousand years ago. The Egyptians opened the first metal mines six thousand years ago. Five thousand years ago the same ingenious people were using a tubular rock drill. At the same time they led the world by centuries in the civilization of science and mechanics, but they produced no men of literature.

J. H.

MINING.

Possibilities of Diamond Drilling. By Robert Davis Longyear. (Salt Lake Mining Review, March 30, 1920.)

The diamond drill, though not a new machine, is only recently finding the wide application it deserves. It is true that after ore has been found with a diamond drill it becomes necessary to drive a drift to mine it. But this is so seldom, in exploration work, compared to the instances where negative results are obtained that much fruitless development work can be spared by the intelligent use of the diamond drill. Some of the purposes for which the drill is especially adapted are:

1. Prospecting below water level.
2. Obtaining general geologic information.
3. To ascertain the limits of an ore-body before deciding on an economical method of mining it.
4. To search for faulted segments.

The author gives cost, technical and general data relative to diamond drilling operations. He suggests contracting on a "cost plan" basis as being the most advantageous to all concerned.

C. E. W.

Neutralizing Mine Waters on the Rand. By F. Wartenweiler and E. H. Croghan. (M. & S. P., March 13, 1920.)

The four objects to be held in view in the treatment of mine water, according to the authors, are as follows: (1) The prevention of pipe corrosion; (2) the settlement of suspended solids to prevent pipe choking; (3) the utilization in the reduction works of water free from precipitated salts; (4) the utilization of the water for spraying and underground washing. The current neutralizing agents are soda, calcium carbonate and lime. Soda effects precipitation the most rapidly, but it does not clear the water as well as the other re-agents. J. H.

The Bunker Hill Enterprise—VII. By J. A. Rickard. (M. & S. P., April 3, 1920.)

The development of crushing and concentrating practice is outlined. The first mill was built in 1866. This was followed in 1890 by the Old South Plant, in which the first flow sheet was elaborated. The next mill, the West No. 1, began operations in 1909. Its scheme of treatment is given in detail. Very complete descriptions with tables and diagrams are given of the grading system for re-dressing jig concentrates, the influence of sizing on jig operations, and the Bunker Hill and Callow screens, as well as the other equipment. No. 2 West Mill started in 1912.

J. H.

Thawing Frozen Gravel with Gold Water, By Walter S. Weeks. (M. & S. P., March 13, 1920.)

This is a report on experiments in thawing made by John H. Miles at Nome. It was found that superheated steam thawed 109 cubic yards in 156 hours; saturated steam thawed 83 cubic yards in 98 hours; hot water thawed 81 cubic yards in 67 hours; and cold water thawed 511 cubic yards in 192 hours. The steam penetrated clay only to a slight extent. Most of it was expended in keeping a comparatively quiet body of water hot. The hot water application showed uniform thawing, but a low efficiency. Cold accomplishes all that is desired, at a slight expense.
a slight expense. J. H.

The Dolly Varden Mine. By Robert Dunn. (E. & M. J., March 13, 1920.)

This mine, in British Columbia, is Canada's newest silver producer of importance. Within five months after production began the mine shipped four hundred thousand ounces of silver. The metal is in the form of proustite, pyrargyrite, cerargyrite and native silver. The Dolly Varden Mines Co. received from the Canadian government many rights and privileges, contingent upon the completion and operation of a company railway by the end of 1918. This time limit was later extended by special legislation. Difficulties arose and the Traylor Engineering Co. acquired control of the mine. J. H.

An Oil Engine Installation in New Mexico. By Theodore M. Robre. (E. & M. J., March 27, 1920.)

Description of the Snow semi-deseil engine power plants of the Empire Zinc at Hanover and Cleveland, New Mexico. Engines run 98 percent of the time with a fuel consumption of 0.45 lbs. oil per b.h.p. Engines are 250 h.p., four cycle. C. E. W.

Mine-Sampling. By W. H. Wagner. (M. & S. P., March 27, 1920.)

Author describes method of sampling used by the North Butte Mining Co. of Butte, Mont. Samples of each heading are taken daily, assayed, the results transferred to the shift-bosses note-book, maps and stope cross-sections. Maps greatly facilitate work of getting out reports and estimating reserves, in addition to making mining more economical. Illustrated with several photographs of maps and record blanks. C. E. W.

METALLURGY AND ORE-DRESSING.

Magnetic Separation of Bismuth, Tin and Tungsten Concentrates in Tasmania. By Wm. E. Hitchcock and J. R. Pound. (M. & S. P., March 13, 1920.)

The use of Wetherill Magnetic Separators is here described as well as the conditions necessary for its satisfactory operation. At Launceton complex material containing bismuthite, cassiterite and wolframite are separated magnetically into firsts and seconds. The concentrates are cleaned after roasting to convert pyrite. Details of the roasting process and sundry applications of the process to custom ores are given. It is possible to remove with a magnet from one-half to two-thirds of the original concentrate. J. H.

The Requirements of Refined Copper. By Lawrence Addicks. (C. & M. E., March 10, 1920.)

The requirements of refined copper are explained as to electrical conductivity, pitch, ductility, casting and dimension. Impurities in copper, which affect conductivity, may be soluble, partly soluble or insoluble. "Pitch" refers to the appearance of the copper with regard to cavities and variations in texture caused by faulty control of the gases incidental to molten copper. Troubles from brittleness are generally traceable to a low pitch. Tensile strength and torsion depend entirely on the thin coating over the mine; with this removed the torsion is increased several times. J. H.

Pulverized Lignite Fuel in California. By Roy N. Buel. (Met. & Chem., March 31, 1920.)

This article discusses the lignite fields in a commercial way, and shows how relatively poor coal can be used to a decided advantage by pulverizing it. The burning of pulverized lignite coal under boilers and in metallurgical plants is coming into use very rapidly. Coal is high as 20 percent ash have been reported to have been used to a great advantage. The article is very interesting in that it gives the operation of the combustion equipment, advantages of burning pulverized lignite and results obtained in a power plant. F. A. L.

The Ganelin Chloride Process. (Mining Magazine, March, 1920.)

This is a description of the Ganelin chloride process for silver-lead-zinc middlings, etc. The patentees are Solomon Ganelin & Co., of Brooklyn. It is a British Patent, No. 20,781, of 1918 (135,968), and contains the best of information relative to the chloride process which is being tested by the Amalgamated Zinc Co., Ltd.

Briefly, the process is to chloridize lead-silver-zinc ores. Other ores are also reduced to chlorides, and the metals recovered by leaching. F. A. L.

The Electrolytic Zinc Plant of the Judge Mining and Smelting Co. at Park City, Utah. By L. S. Austin. (M. & S. P., March 20, 1920.)

The zinc concentrates treated are considered by the writer as coming from the jigs or from the tables. They contain 35 percent zinc, 8 percent iron, 5 percent silica, 31 percent sulphur, 3.5 percent lead, and 15 ounces of silver. The effect of high altitudes upon the roasting process is described. The copper and cadmium dissolved in the thickened slime are removed by the addition of zinc dust. The cadmium is later removed from the precipitate by dissolving it in dilute sulphuric acid and electroiyzing it. J. H.

A Modification of Horwood's Process for the Flotation of Copper-Zinc Ores. By H. L. Hazen. (M. & S. P., March 27, 1920.)

Mr. Hazen's article deals with the difficulty of separating sphalerite from sulphides of copper. Horwood's method was: First, the extract of the sulphides in a mixed concentrate; second, quick roasting of the concentrate at about 400 degrees C.; third, re-treatment by flotation. Mr. Hazen advocates as a modification the oxidation of the copper ores by roasting, and then their leaching. Flotation would then effect the final separation. The details of tests made under this modification are given in two tables. The great advantage of this system is that it does not require the delicacy of control as Horwood's method. J. H.

Commercial Development of Fused Silica. By John Scharl and Wallace Savage. (C. & M. E., March 31, 1920.)

This is an account of the development of the electro-thermal processes of fusing glass sand. Fused rock crystal ware is very transparent and may be used for thermometer stems and ultra-violet ray tubes. The reactions between carbon and silica, and the application of gas phases are discussed, as well as the peculiar phenomena of fused silica. The commercial production was negligible before 1904, when the Thermal Syndicate, Ltd., of England, began producing fused sand ware. The article ends with an explanation of the important properties of fused silica. J. H.

Aluminum Rolling Mill Practice—I. Commercial Pig and Scrap. By Robert J. Anderson and Marshall B. Anderson. (C. & M. E., March 17, 1920.)

This is the first of a series of articles discussing the details of rolling and mill practice for aluminum, including all phases of work from pig metal to finished sheet. Metal for melting is considered in this installment. Its especially interesting features are a table of the various specifications for pig aluminum as given by the Navy Department and a table showing a typical analysis of pig aluminum. J. H.

Aluminum Rolling Mill Practice—II. Melting Furnaces, Ingot Pouring. By Robert J. Anderson and Marshall B. Anderson. (C. & M. E., March 24, 1920.)

Continuous vs. intermittent melting prior to casting rolling mill ingots is discussed in their second installment. They demonstrate that intermittent melting gives better results, but is practical from a standpoint of efficiency only in small plants. In large plants the advantage of economy and increased production make continuous melting admissible. In the discussion of transferring molten metal by tapping or ladling, it appears that tapping allows less chance for the metal to cool, and is cheaper. J. H.

Aluminum Rolling Mill Practice—III. By Robert J. Anderson and Marshall B. Anderson. (C. & M. E., March 31, 1920.)

Specifications and some of the uses for sheet aluminum are noted, followed by a discussion of furnaces for heating ingots preparatory to slabbing tables and examples of calculations are given, whereby individual orders may be rolled with minimum allowance for scrap. The practice of rolling aluminum ingots without preheating in a furnace is condemned because there is no possibility of temperature control. J. H.

GEOLOGY.

The Ore Deposits of Mexico—I. By S. J. Lewis. (M. & S. P., March 20, 1920.)

In this first article of the series Mr. Lewis declares his purpose to be the exposition of the ore deposits of Mexico. with a discussion of their origin in untechnical language. He classifies the geology of the country upon the basis of Pre-Cambrian, Paleozoic, Mesozoic, and Cenozoic time. The formation of lode channels, their mineralization, the magnetic theory, and the theory of enrichment by circulation are all dealt with. A study of the special conditions which make all ore deposits different is promised in a later article. J. H.

The Ore Deposits of Mexico—II. By S. J. Lewis. (M. & S. P., March 27, 1920.)

Ore deposits in sedimentary rocks are here classified as true contact deposits, non-contact deposits, combination forms, and limestone ore deposits. The Borreno Mine is cited as an excellent example of the true contact deposit. Three stages are distinguishable: The deposition of primary sulphides; the entrance of silicious solutions; and the oxidizing enrichment of the sulphides. The Ajuchitlan Mine is another example of the same type. Mineralization by replacement and the origin of antimony ore in the Santa Maria Mines are explained as being due to emanations from a laccolith. J. H.

OIL.

The Distillation of Shale-Oil. By James A. Bishop. (M. & S. P., March 13, 1920.)

The commercial products into which kerogen may be resolved are the important features of this article. The chief hydrocarbon compounds are methane. ethane, propane, butane, pentane, and hexane. The three grades of distillates are: (1) Those whose boiling points range from zero to 150 degrees C.; (2) those boiling between 150 degrees C. and 300 degrees C.; (3) those boiling above 300 degrees C. Shale distillates are all included in the first thirty-five members of the paraffin series. Paraffins only are found in shale and the presence of olefines and benzenes indicates improper distillation. In Europe this distillation is assisted by a discharge of large volumes of steam into the shale.

J. H.

Composition of Petroleum and Its Relation to Industrial Use. By C. F. Moberg, S.D. (Mining Journal, March 13, 1920.)

So far as the elementary composition of petroleum is known it may be briefly stated that petroleum consists principally of a few series of hydrocarbons, with minute admittures of sulphur, nitrogen, and oxygen derivatives, which may be regarded as impurities to be removed in the preparation of commercial products. The author discusses the classification of petroleum in great detail and points out their influence upon commercial products. The article is to be continued.

F. A. L.

Wild Boom in the North Texas Oil Fields. By H. A. Wheeler. (E. & M. J., March 27, 1920.)

Author reviews history of developments in the various North Texas fields, laying special emphasis on Burkburnett and Ranger. He describes the various promotion schemes in vogue at the different stages of development. Burkburnett has been ruined by over-drilling. Production after six months is shrinking at the rate of 30 to 60 percent per month. Field 90 percent exhausted. Yield about 8,500 barrels per acre. Average depth, 1,700 feet; cost of well, $30,000.

Ranger field average production about 1,200 barrels per acre; wells, 3,200 feet deep; cost, $50,000. Wells decline very rapidly. Field two-thirds exhausted. Production seems to come from crevices in limestone rather than sands.

Other fields described are Desdemona, Breckenridge, Petrolia, Electra, Brownwood and Moran. A general map of Texas, showing position of wells, is included. Also a financial estimate of the operating results of a typical Ranger lease. Recommend article to anyone interested in oil industry. C. E. W.

Oil Well Pumping Methods and Equipment. By Seth S. Langley. (E. & M. J., March 27, 1920.)

Article contains numerous drawings, estimates of cost and other engineering data relative to the equipment used in pumping oil wells. Splendid reference article for those contemplating operating oil wells. C. E. W.

OHMS, AMPERES AND VOLTS EXPLAINED.

When an electric current is flowing in the trolley wire or electric lighting circuit there are three factors involved. One of these is the pressure expressed in volts which causes the current to flow; another is the resistance or opposition offered by the circuit to the flow which is expressed in ohms; the last is the current strength or volume, expressed in amperes which is maintained with the circuit as a result of the pressure overcoming the resistance. The ohm is named in honor of George Simon Ohm, a distinguished German electrician. The volt is named after the Italian scientist, Volta. The ampere is named after the French scientist, Ampere.

The unit of current is called the ampere. The unit of electrical pressure or electromotive force is called the volt. The unit of resistance is called the ohm. The unit of electric power is the volt-ampere and this is called the watt. Seven hundred and forty-six watts per hour equals one horse power. The unit of energy—the product of electric power and time—is called the joule, but this unit is too small for practical purposes and the kilowatt-hour is used instead. The kilowatt-hour is the work done by a thousand watts working for one hour.

These electrical terms are as familiar to electrical engineers as feet and inches to the average boy; the layman does not understand because he has never been taught, has never had to use the terms, has never read about them.

It is easier to understand these terms if we consider electricity as a fluid and liken it to a current of water flowing through a pipe. The rate of flow of water in the pipe depends upon the gravitation and the height of the reservoir or source above the outlet. The greater the height of the source the greater will be the pressure of water and the greater the flow in gallons per minute. It is just the same with electricity. A current flows from a high potential to a low potential whenever the two are joined by a conducting wire. It is merely a difference of level.

DISCUSSION

On March 10 the secretaries and presidents of the Alumni Association of Colorado University, Denver University, Colorado Agricultural College, Colorado College, Colorado State Teachers' College, and the Colorado School of Mines, met at a luncheon, given by the Alumni Council of Denver University, to discuss the desirability of forming a federated alumni organization. The following is the constitution which was decided upon at a subsequent meeting, held in the Denver Civic and Commercial Association's headquarters in the Chamber of Commerce Building on March 18:

CONSTITUTION of the COLORADO INTERCOLLEGIATE ALUMNI ASSOCIATION.

Article I—Name.

The name of this Association shall be **The Colorado Intercollegiate Alumni Association.**

Article II—Objects.

The objects of this Association shall be:

1. To handle state and national problems affecting the educational interests of Colorado colleges and universities.
2. To aid in raising the standards of educational work in all colleges and universities represented in the Association.
3. So far as practicable, to encourage uniform policies for each Alumni Association.
4. To consider and to aid in any public, political or other matters of interest to the higher educational institutions of this state.

Article III—Officers.

Section 1. The officers of this Association shall be:

President.
Vice-President.
Secretary-Treasurer.

Sec. 2. **Executive Committee.** An Executive Committee shall be created consisting of the presidents and secretaries of all Alumni Associations of Colorado institutions affiliated with this Association.

Sec. 3. **Advisory Board.** An Advisory Board consisting of the President, Vice-President and Secretary of the Colorado Intercollegiate Alumni Association shall have full power to transact all business for the Association. They shall report their action in full at the next meeting of the Executive Committee, and they are instructed to send a written report to each member of the Executive Committee after each meeting of the Board.

Sec. 4. The officers of the Executive Committee shall consist of a **President, Vice-President** and **Secretary-Treasurer.** These officers shall be the officers of the Colorado Intercollegiate Alumni Association. They shall be elected for one year and shall hold office until their successors have been elected and duly qualified.

Sec. 5. These officers shall perform their usual duties, unless otherwise specified by the Executive Committee.

Sec. 6. The Executive Committee shall have general charge and control of the affairs of the Association. They may appoint persons to fill any vacancy in any office until the next regular meeting of the Association.

Article IV—Meetings.

Section 1. The meetings of this Association shall be at such time and place as may be determined by the Advisory Board.

Sec. 2. The first Saturday of each October shall be the annual meeting at which time the election of officers shall take place.

Article V—Membership.

Section 1. Any Colorado Alumni Organization may become a member of the Colorado Intercollegiate Alumni Association upon application and election by a majority vote of the Executive Committee.

Sec. 2. All members in good standing of the organized Colorado Alumni Associations affiliated with this State Association shall automatically become members of the Colorado Intercollegiate Alumni Association.

Sec. 3. Each individual association shall be represented at the meetings of the Colorado Intercollegate Alumni Association by the presidents and secretaries of said Associations. Meetings of this State Association shall be open to all members of Alumni Associations represented.

Article VI—Finances.

There will be no regular dues in this Association, but funds necessary for maintaining the Colorado Intercollegiate

Alumni Association shall be raised by an assessment levied by the Executive Committee on the different Alumni Associations which are members.

Article VII—Voting.

Section 1. All questions before the Executive Committee shall be determined by a majority vote of the Alumni Associations which are members of the Colorado Intercollegiate Alumni Association.

Sec. 2. Each institution or Alumni Association so affiliated shall be entitled to one vote.

Article VIII—Amendments.

These articles may be amended or added to at any meeting of the Association by a two-thirds vote of the members of Alumni Associations present, providing a notice shall have been sent to each Alumni Association represented in the State Association at least five days previous to the day of the meeting, outlining the amendment and object thereof.

The present officers of the temporary organization known as the Colorado Intercollegiate Alumni Association are:

Stuart L. Sweet.........President
President Alumni Association,
University of Denver.

J. J. Laton........Vice-President
President Alumni Association,
University of Colorado.

Roud McCann.........Secretary
Secretary Alumni Association,
Colorado Agricultural College.

These men will hold office until the annual meeting of the Association is held in October, 1920, as provided in the Constitution.

We trust our Alumni members will give this their serious consideration. If you have any suggestions let us hear them.—Editor.

School News

FACULTY REAPPOINTMENTS.

On Thursday, April 8, the board of trustees held their regular meeting. They voted a 10 to 25 percent salary increase to the members of the faculty. This will become effective September 1st.

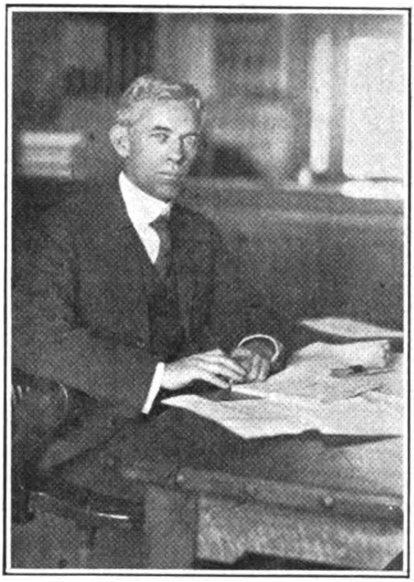
All members of the present faculty were reappointed, with the exception of Professor J. C. Roberts, of the coal mining department, and Mr. H. M. Cronin, chemist at the Experimental Plant, who resigned to enter private business.

1920 GRADUATING CLASS.

Thirty-nine members of the Senior Class will receive the degree of Engineer of Mines on May 10. Dr. John A. Barrett, director of the Pan-American Union, Washington, D. C., will deliver the commencement address.

MINES SERVICE RECORD.

Have we your service record correct to date? We are requested by the Historian of Colorado to supply sufficient information for a book that is being prepared relative to the part the Colleges of Colorado played in the World War. Send us a concise statement of your rank at discharge, branch of service, length of service, major operations in which you participated, and wounds received. See that your friends give us this information. If we do not have you listed correctly after this is published it will be your fault.



T. C. Doolittle

T. C. Doolittle, our well-known Registrar, is still handling the Mines' exchequer. This will probably remind you of the semi-annual conferences you had with him in which you always were the "loser."

Electric lamps are now successfully made in China. An Edison lamp factory in Shanghai turns out 7,000 completed lamps daily.

Alumni News

ALUMNI BANQUET.

The Annual Meeting and Banquet of the Alumni Association will be held at the Metropole Hotel in Denver, Saturday evening May 8th at 6:30 p. m. Cost per plate $2.00.

All members of the present Senior Class are invited to attend as guests of the Alumni Association.

We urge every Alumnus to attend, and request that you immediately advise the Assistant Secretary, Mr. C. Erb Wuensch, that you will be present.

Come and renew the friendships of your college days. You will meet not only your old friends, but many who desire to meet you.

R. B. PAUL,
Pres. C. S. M. Alumni Association.

The Nominating Committee report the selection of the following candidates for the election of officers of the Alumni Association for the year 1920:

For President—W. H. Coghill, '03; J. E. Dick, '12.

For Vice-President—A. V. Corry, '98; C. B. Neiswander, '13.

For Secretary—S. Z. Krumm, '14; W. P. Simpson, '01.

For Treasurer—A. S. Richardson, '12; R. T. Sill, '06.

For Member Executive Committee—A. J. Hiester, '12; E. R. Ramsey, '12.

(Signed) LOUIS COHEN, '97,
CLARENCE MALSTROM, '00,
CHAS. M. GLASGOW, '10.
ROSS R. MAY, '12,
E. S. GEARY, '12.
Nominating Committee.

ELECTRIC OVENS FIND WIDE APPLICATION IN AUTOMOBILE PLANT.

The electric oven installation of the Tarrytown plant of the Chevrolet Motor Company consists at the present time of twenty ovens of various sorts. Of these, eighteen are heated entirely by electricity, and two by a combination of steam and electricity, the whole installation making a total connected load of 2,400 kilowatts.

The General Electric Company has furnished the heating and control systems for many of these ovens throughout the country, which are doing many varieties of work, with a saving over gas, and fuel heated ovens that averages about 20 per cent in actual operating cost, not including the percentage of spoiled material turned out by the fuel furnace.

PERSONALS

'96.

William H. Paul is consulting engineer for the International Railway of Central America; address 17 Battery Place, New York City, N. Y. He is temporarily at the Utah Hotel, Salt Lake City.

'97.

J. Norman McLeod, mining engineer for the Rare Metals Refining Co., 309 South Broadway, Los Angeles, Calif., is examining mining properties in the Western states.

'99.

Gilbert L. Davis, who is with the U. S. Reclamation Service, has moved from Saco, Mont., to Missoula, Mont.

'00.

Daniel Harrington is in the Couer D'Alenes in behalf of the mine ventilation investigations that he is conducting in the large mining camps of the West for the U. S. Bureau of Mines.

'01.

Karl C. Parrish is at Barranquilla, Colombia, South America.

'05.

L. P. Pressler has resigned his position with the Johns-Manville Asbestos Co. at Asbestos, Quebec, Canada, to join the engineering staff of the St. Joseph Lead Co. at Bonne Terre, Mo.

E. E. Greve is chief engineer with the Oil Well Supply Co., 215 Water St., Pittsburgh, Pa.

'06.

Wm. H. Finigan is president of the MacGowan & Finigan Cordage Co., 432 Pierce Bldg., St. Louis, Mo.

Mr. and Mrs. Max W. Ball announced the arrival of Douglas Schelling Ball at Cheyenne, Wyo., on March 5.

J. Marvin Kleff is on an extensive tour of the United States. He expects to visit the various mining camps of interest in Arizona and New Mexico, the oil fields of Texas and Louisiana, and thence several of the cities on the Eastern coast.

Seely B. Patterson is manager of the Calcite Quarry Co., Myerstown, Pa.

'07.

George P. Moore is chemist for the Wallace-Barnes Co., Bristol, Conn.

J. P. Golden is in the abstracting and realty business at O'Neill, Nebraska.

H. C. Armington is superintendent of the Buckeye Petroleum Co. and the Marigold Oil & Refining Co at Wichita Falls, Texas. Address, 2413 Ninth Street.

'08.

H. D. Whitehouse is with the Continental and Commercial Securities Co. of Chicago, Ill.

'09.

J. T. Boyd has returned to Colorado from New York. He is temporarily at 1115 Race Street, Denver, Colo.

C. E. Lesher, Director of Statistics for the Distribution Division of the U. S. Fuel Administration, is the author of "The Distribution of Coal and Coke"—Part I, which has recently been issued. This is replete with graphs, statistics and economical aspects of the industry.

'10.

A. E. Perkins is back to his old position of Western manager for the Colonial Steel Co., 308 Kearns Building, Salt Lake City, Utah. He was with the naval engineers during the war.

H. H. Juchem, of the Aguacate Mines, San Mateo, Costa Rica, has been examining mines and prospects in the southern part of Costa Rica.

Emil J. Bruderlin's address is care Cia Minerales y Metales, S. A., Monterrey, N. L., Mexico.

'11.

Georgia Smith, wife of Roy F. Smith, died at her home in Denver, on March 19, after an illness of over a year. Mr. Smith is with the Empire Zinc Co. at Gilman, Colo.

Arthur N. Sweet is manager of the American Asbestos Mining & Milling Co., at Idaho Falls, Idaho. He was a visitor in Golden the latter part of March.

Otto Herres, Jr., is superintendent of the United States Fuel Co., Hiawatha, Utah.

'12.

W. G. Ramlow has moved from St. Paul, Minn., and is again with the Empire Zinc Co. at Hanover, New Mexico. He is engaged in construction work.

Leon M. Banks is leasing at Metcalf, Arizona.

Chas. L. Harrington has been transferred from Naturita, Colo., to the Denver office of the Radium Company of Colorado.

'13.

Richard A. Leahy is assistant mill superintendent at the St. Joseph Lead Co., Bonne Terre, Mo.

Harvey Mathews has accepted a position with the Antoro Mines Co., Bonanza, Saguache County, Colo.

'14.

A. Ringgold Brousseau has joined the geological staff of the Rood Oil Corporation at Bartlesville, Okla.

Wm. G. Zulch is with the Vindicator G. M. Co., 603 Symes Bldg., Denver, Colo.

'15.

G. H. Van Dorp is with the Black Hawk Consolidated Mines Co. at Vanadium, New Mexico. Van Dorp was recently married to Mrs. Mabel Hyland Rooney of Golden, Colo.

Mr. and Mrs. John N. Teets announce the arrival of a son, December 21, 1919, at Whitepine, Colo.

Samuel J. Burris, Jr., is engineer for the Metals Exploration Co., Denver, Colo.

'16.

V. D. Howbert has returned to Colorado Springs from California owing to the closing down of the Afterthought Copper Mines.

C. B. Gauthier is manager of the Carbondale chemical plant at Carbondale, Ill. He is associated with Dr. Herman Fleck, former Professor of Chemistry at Golden.

Frank T. A. Smith is at Burnet, Texas. He is with the Meadows Oil & Chemical Corporation of New York.

'17.

George Goldfain is Chief Chemist for the Great Western Sugar Co. at Fort Morgan, Colo.

Lisle R. Van Burgh left Casper, Wyo., and is now geologist for the Frantz Corporation, Wuinett, Mont.

'18.

Thomas P. Allan has gone to Alaska to assist Mr. E. R. Cooper, of New York, on a four months' examination trip.

EX-MINES NOTES.

'06.

James S. James is superintendent of mines for the Radium Company of Colorado, Inc., at Naturita, Colo.

'09.

Forrest Mathez is now superintendent of the Silver King Coalition Mines Co., Park City, Utah.

'10.

Theodore Pilger is employed in the foreign sales department of the Allis-Chalmers Co., Milwaukee, Wis.

WHERE ARE THESE MEN?

Louis S. Cain, '13.
Chas. Adams, '04.
Ward Blackburn, '08.
Alan Kissock, '12.
Donald S. Giddings, '00.
A. F. Hallett, '09.
M. R. Valentine, '98.
W. E. Canning, '09.
Norman R. Copeland, '18.
Frank H. Jones, '98.
A. L. Levy, '06.
S. J. Clausen, Jr., '11.
A. F. Richards, Ex.-'08.
D. O. Russell, '10.
Truman D. Prier, '04.
T. H. M. Crampton, '14.
Geo. M. Lee, '10.
C. B. Hull, '09.
Van Cleave A. Olson, '15.
Joseph U. G. Rich, '08.
G. J. Wackenhut, '04.

ATHLETICS

By F. A. Litchenheld, '20.

BASKETBALL.

Mines 27; Aggies 21.

The Mines basketball team defeated the Agricultural team by the score of 27 to 21. The game was a fast one and the score very close at all times. The Mines forged ahead toward the end. The team work of the Mines was a big factor in their scoring. Dunn, Bryant, and A. Bunte, as usual, did excellent work for the Mines.

During the first half, little scoring was done. It ended with a tie, 9 to 9. The play was fast, but neither team seemed to have much accuracy in shooting baskets.

In the second half, the Mines opened up in a brilliant fashion and soon ran up a big lead. The Farmers came back strong and for a time it looked as though they would overtake the Mines lead.

Mines 23; D. U. 10.

In the last basketball game of the season, Mines defeated D. U. by the score of 23 to 10.

The game was at times very rough. Towards the end it was well played. In floor work, D. U. showed well, but when it came to putting the ball through the hoop for field goals, they could not score with consistency. In fact, the team made but two field goals.

A. Bunte was disqualified because of personal fouls; he was the best scorer for Mines, and played a splendid game. Bryant, at center for the Ore Diggers, played his usual game. Chase was D. U.'s star.

CONFERENCE STANDING.

Because of C. C.'s victory over Aggies, this gives the Mines second place in the conference. The standings of the clubs are as follows:

Club	Won	Lost	Pct.
University of Colorado...	6	2	.750
Mines	5	3	.625
Aggies	4	3	.586
Colorado College	4	3	.586
Denver	1	7	.125

DAVIS ELECTED CAPTAIN.

A. D. Davis, who played guard on the basketball team this year, was elected captain of next year's team. This is Davis' first year at Mines. His playing at guard was excellent, although he had little chance for spectacular work. He always helped to keep the opposing team's score at a minimum. He was given the honorable mention in all-conference choice as guard against such men as Brown and McTavish.

Bryant secured all-conference position, and is the only Miner to get a place on this team. A. Bunte and Davis were given an honorable mention. Bryant, with Brown and Welland, of Boulder, were unanimously chosen. The All-Conference Team was:

Willard, Colorado, forward.
Bryant, Mines, forward.
Bresnehan, Aggies, center.
Brown, Colorado, guard.
McTavish, C. C., guard.

Honor Roll—centers: A. Bunte, Mines, Holman, of C. C.; guards: Schrepferman, of Colorado, Davis, of Mines, and Iliff, of Denver.

BASEBALL.

Coach Glaze is starting off the baseball season at the school with the same zest as he did in football. Four players are not eligible for the team. Chuck Schneider is barred on account of having four years of athletics to his credit. Severini, McGlone and Benjamin are the others who are barred because of the Conference "one-year" rule. But in spite of this Glaze hopes to have a strong team this year. Judging from the material on hand, he should make a strong showing. So far he has no pitcher who can be called upon to deliver the goods, but no doubt he will develop one.

Mines have defeated the West Denver High School in a four-inning game with a 20-5 score. The first Conference game will be played with the Aggies on April 23. The schedule:

April 23—Aggies vs. Mines.
April 24—Aggies vs. Mines.
April 30—Mines vs. CC.
May 1—Mines vs. C. C.
May 4—Mines vs. D. U.
May 7—C. C. vs. Mines.
May 8—Wyoming vs. Mines.
May 13—Wyoming vs. Mines.
May 14—Mines vs. Colorado.
May 20—D. U. vs. Mines.
May 21—Colorado vs. Mines.

Enough hydro-electric energy is running to waste here in the United States to equal the daily labor of 1,800,000,000 men.—Franklin K. Lane, Secretary of the Interior.

WORLD'S PRODUCTION OF CHROMITE IN 1918.

In view of the record-breaking production of chromite in the United States in 1918, reported by the United States Geological Survey, Department of the Interior, it is of interest to note the part it played in the world's output for that year. The approximate output in round numbers for the country is expressed below in metric tons.

World's Production of Chromite in 1918.

United States	84,000
Canada	20,000
Cuba	9,000
Guatemala	1,200
Brazil	18,000
British South Africa	28,000
Turkey (Asia Minor)	14,000
Greece	10,000
Austria-Hungary	500
Russia	16,000
India	20,000
Australia	800
New Caledonia	26,000
Japan	8,000

France, with 9,000,000 horse power, is the richest country in Europe in waterfalls.

ALMOST AS HOT AS THE SUN.

The electric furnace in actual use has reached the temperature of 3,500 degrees C. Recent experiments have, however, developed a furnace which gives a temperature of 4,500 C., enough to volatilize diamonds. A comparison of these temperatures with that of the sun, which is estimated at 5,000 degrees C., gives a striking idea of what can be accomplished in handling refractory substances with electric heat.

The Roessler & Hasslacher Chemical Co. have moved from 100 Williams Street to their new and more commodious quarters at 709-719 Sixth Avenue, corner 41st Street, New York, N. Y.

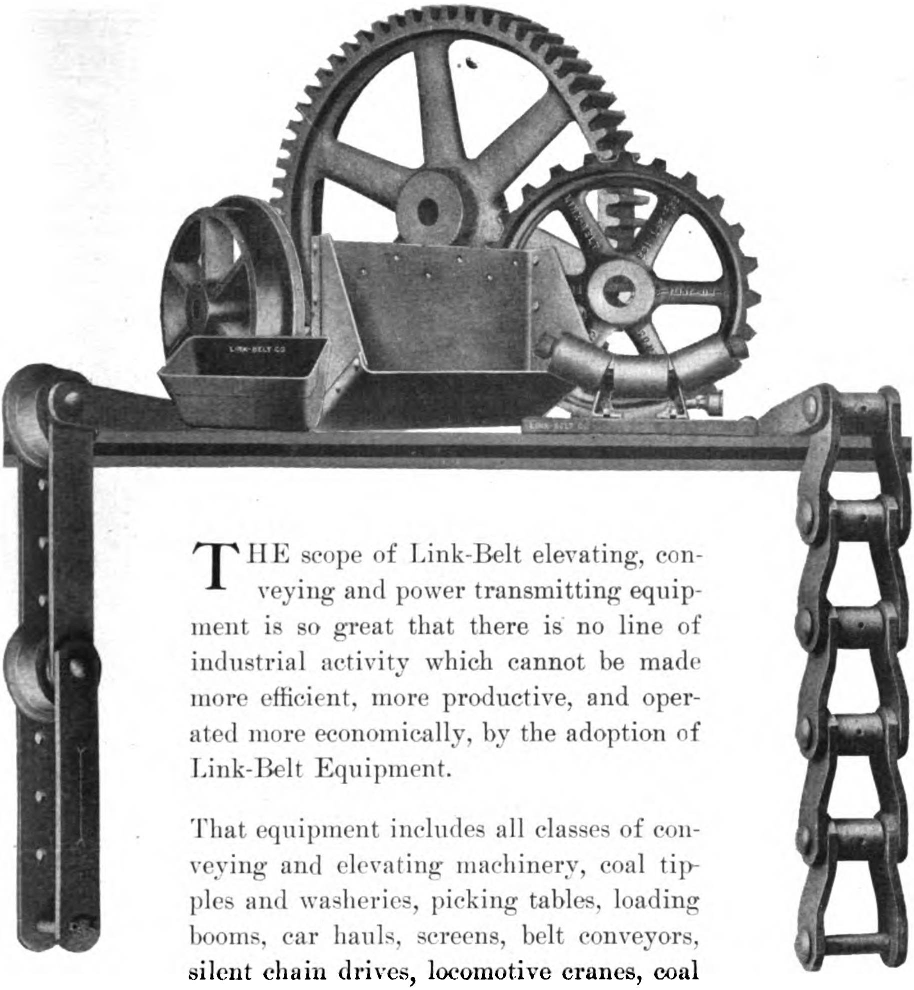
At the Annual Meeting of Midwest Forge & Steel Co., East St. Louis, Ill., U. S. A., the following new officers were elected: J. W. Eschenbrenner, President and Treasurer; C. T. Coates, Vice-President and General Manager; E. A. Eschenbrenner, Secretary. The business was established in 1885, and for the past five years has been specializing in Cement Mill and Mine Forgings, particularly Grinding Plates and Steel Balls.

PROFESSIONAL CARDS

VOL. X OCTOBER, 1920 No. 10

COLORADO SCHOOL OF MINES MAGAZINE

THE COLORADO SCHOOL OF MINES ALUMNI ASSOCIATION, PUBLISHERS, GOLDEN, COLO.



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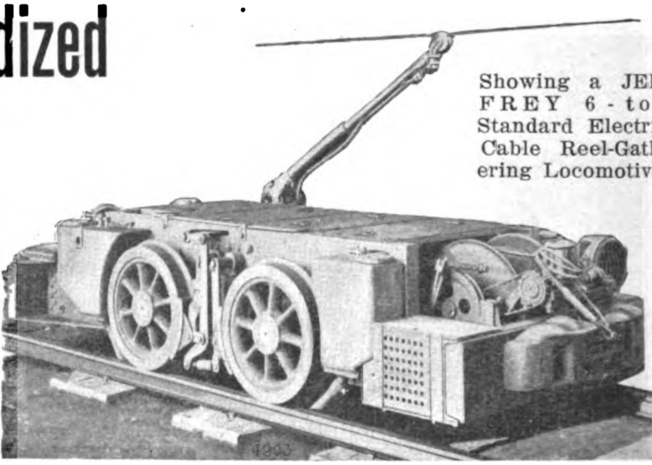

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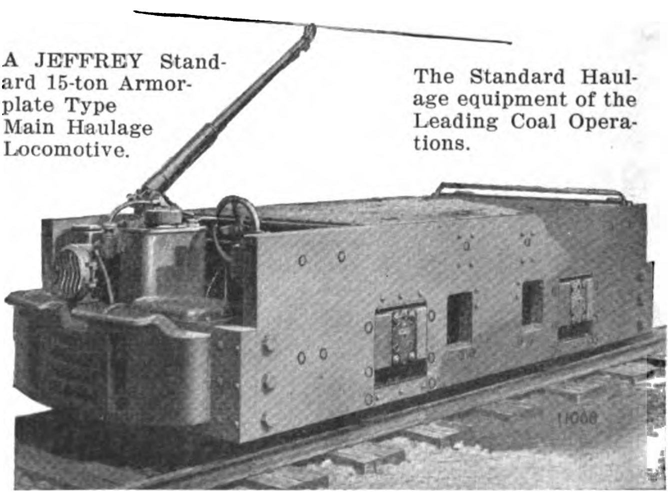

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